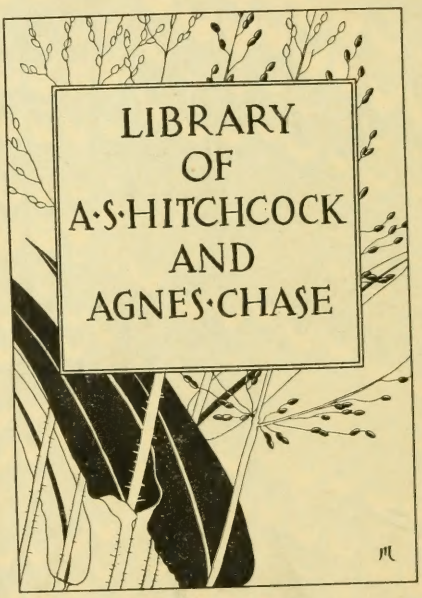

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VOLUME 14, PART 3

THE GRAMA GRASSES:
BOUTELOUA AND RELATED GENERA

By DAVID GRIFFITHS



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1912

BULLETIN OF THE UNITED STATES NATIONAL MUSEUM

Issued February 24, 1912.

PREFACE.

The paper offered herewith, by Mr. David Griffiths, of the Bureau of Plant Industry, United States Department of Agriculture, is a systematic account of the grasses of the genus Bouteloua and closely related genera, chiefly of the species found in North America. These are native grasses, some of them among the most important constituents of the natural pasturage of the West. Mr. Griffiths, in the 11 years since the beginning of his study, has had extensive opportunity for the observation of these grasses in the field, chiefly as engaged in the investigation of the public stock ranges for the Department of Agriculture; has examined the specimens in the United States National Herbarium and several other large herbaria; and, for the study of the results obtained by others and the settlement of questions of nomenclature, has had at hand the resources of the Washington libraries.

FREDERICK V. COVILLE,
Curator of the United States National Herbarium.

CONTENTS.

	Page.
Introduction	343
Basis and methods of the work	343
Economic importance of the grama grasses	344
Adaptability to cultivation	345
Distribution	346
Illustrative material	348
Limitation of the genera	348
Bibliographical notes	350
Description of the genera and species	351
List of specimens deposited in public herbaria	425
INDEX	IX

ILLUSTRATIONS.

PLATES.

Facing page.

PLATE 67. Habitat of *Bouteloua* spp. in the Tucson Mountains, Arizona 343
68. A. Closely grazed Bouteloua region in southern Arizona. B. Habitat of tall-growing species of Bouteloua in southern Arizona 345
69. A. *Bouteloua curtipendula* (Michx.) Torr. in cultivation. B. *Bouteloua gracilis* (H. B. K.) Lag. in cultivation 345
70. A. General view of a good Bouteloua region. B. Spring view of a Bouteloua region closely grazed 346
71. A. Typical view in a Bouteloua region showing a variety of species. B. Bouteloua region with a different soil and different species .. 346
72. A. Large native crop of *Bouteloua gracilis* (H. B. K.) Lag. B. *Bouteloua gracilis* on the Mexican border of Arizona 377
73. A. Large plant of *Bouteloua parryi* (Fourn.) Griffiths. B. *Bouteloua barbata* Lag 382
74. A. *Bouteloua trinii* (Fourn.) Griffiths. B. *Bouteloua eriopoda* Torr. 388
75. A. Isolated plant of *Bouteloua rothrockii* Vasey. B. Dense growth of *Bouteloua rothrockii* 392
76. Habitat of *Bouteloua karwinskii* (Fourn.) Griffiths, *B. trinii* (Fourn.) Griffiths, and *B. stolonifera* Scribn 394
77. A. Large plant of *Bouteloua aristidoides* (H. B. K.) Griseb. B. Same species on desert mesas 397
78. *Bouteloua eludens* Griffiths 402
79. *Bouteloua eludens* Griffiths 402
80. A. *Bouteloua eludens* Griffiths. B. *Bouteloua texana* S. Wats 402
81. *Bouteloua radicosa* (Fourn.) Griffiths 412
82. A. *Bouteloua filiformis* (Fourn.) Griffiths. B. *Bouteloua curtipendula* (Michx.) Torr 413
83. *Bouteloua filiformis* (Fourn.) Griffiths 413

TEXT FIGURES.

Page.

FIGURE 19. *Triaena juncea* 355
20. *Pentarrhaphis scabra* 356
21. *Pentarrhaphis polymorpha* 357
22. *Cathestecum prostratum* 358
23. *Cathestecum prostratum* 359
24. *Cathestecum multifidum* 360
25. *Cathestecum erectum* 361
26. *Cathestecum stoloniferum* 363
27. *Bouteloua procumbens* 366
28. *Bouteloua simplex* 367
29. *Bouteloua simplex* 367
30. *Bouteloua stolonifera* 368
31. *Bouteloua scorpioides* 370
32. *Bouteloua scorpioides* 370
33. *Bouteloua hirticulmis* 371

Page.

FIGURE 34. *Bouteloua hirsuta* 374
35. *Bouteloua gracilis* 377
36. *Bouteloua breviseta* 380
37. *Bouteloua parryi* 382
38. *Bouteloua barbata* 383
39. *Bouteloua barbata* 384
40. *Bouteloua arenosa* 386
41. *Bouteloua trinii* 387
42. *Bouteloua trinii* 388
43. *Bouteloua sonorae* 389
44. *Bouteloua eriopoda* 390
45. *Bouteloua rothrockii* 392
46. *Bouteloua rothrockii* 393
47. *Bouteloua karwinskii* 394
48. *Bouteloua alamosana* 395
49. *Bouteloua aristidoides* 397
50. *Bouteloua pringlei* 399
51. *Bouteloua chondrosioides* 400
52. *Bouteloua megapotamica* 403
53. *Bouteloua texana* 404
54. *Bouteloua lophostachya* 405
55. *Bouteloua acuminata* 406
56. *Bouteloua vaneedeni* 407
57. *Bouteloua americana* 409
58. *Bouteloua repens* 410
59. *Bouteloua heterostega* 415
60. *Bouteloua disticha* 416
61. *Bouteloua pilosa* 417
62. *Bouteloua uniflora* 418
63. *Bouteloua curtipendula* 420



HABITAT OF BOUTELOUA SPP. IN THE TUCSON MOUNTAINS, ARIZONA.

Arid low mountain situations occupied by forms of the low-growing species, *B. aristidoides* and *B. barbata*. The main shrubbery consists of *Cereus giganteus*, *Fouquieria splendens*, *Acacia constricta*, *Prosopis velutina*, and Franseria.

THE GRAMA GRASSES: BOUTELOUA AND RELATED GENERA.

By David Griffiths.

INTRODUCTION.

BASIS AND METHODS OF THE WORK.

It was during the writer's connection with the University of Arizona in 1900 that work was begun on this group of plants. Preparations were then made to grow the plants under cultivation at the University in a region where the species predominate in the grass flora and form the main feed upon public and private stock ranges. A change of location caused a change of the plan of work. Since 1901 the writer's studies in the field have been carried on during extensive travel on behalf of the Department of Agriculture for the study of the public stock ranges and other purposes. In addition, travel has been performed extensively in Mexico under conditions which have allowed good opportunity for study.

The material in the following herbaria has been examined: United States National Herbarium, Gray Herbarium, herbarium of the Missouri Botanical Garden, herbarium of the Field Museum of Natural History, herbarium of the California Academy of Sciences (before the fire), and the private herbaria of Brandegee and Tracy. But while the collections in these herbaria were studied, the work is based mainly upon the material in the United States National Herbarium, and the specimens listed are almost entirely from that repository.

During his visit to Europe in 1907, Prof. A. S. Hitchcock secured, through the kindness of the directors of the herbaria there, fragments of several typical or authentic specimens for deposit in the National Herbarium. In other cases he procured photographs of type specimens and made notes and drawings that have greatly aided in the interpretation of the older names of the species. Further information has been obtained through correspondence with the directors of the botanical gardens at Kew and Berlin, to whom acknowledgments are due for their courtesy.

The drawings accompanying this paper were prepared by Mrs. Agnes Chase, to whom the writer is indebted for numerous notes upon the minute structural details of the species. The half tones, except plate 69, are from photographs taken by himself, and now the property of the United States Department of Agriculture.

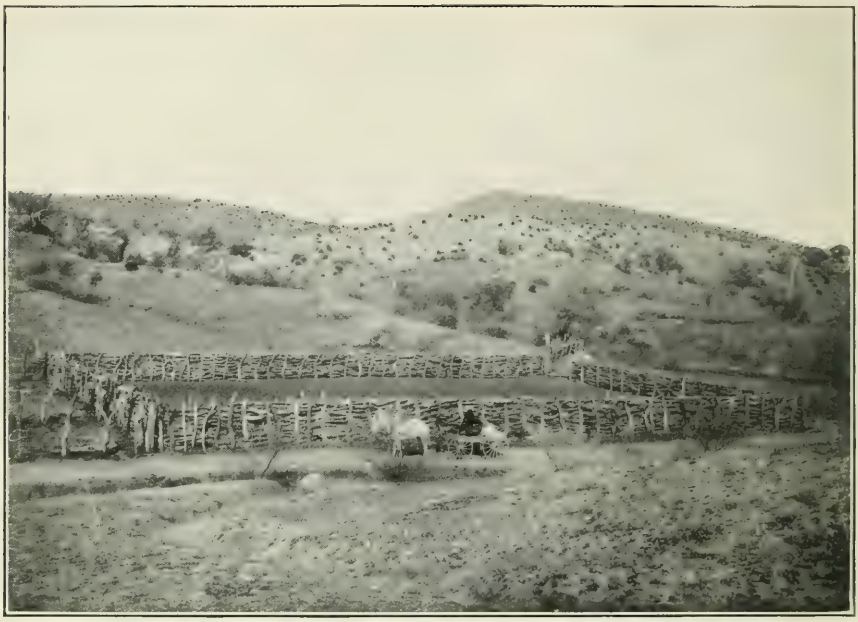
ECONOMIC IMPORTANCE OF THE GRAMA GRASSES.

It is doubtful whether there is another group of native pasture grasses which is of as much economic importance as this, when both quality and quantity are considered. In the northern prairie region *Bouteloua gracilis* forms a very large part of the so-called "buffalo-grass formations," and makes a very fair sod over thousands of square miles. The arable lands upon which this species forms a good turf, however, are rapidly being broken up and devoted to ordinary farm crops, so that in the north the areas of grama have been very much reduced in the last 20 years.

In the arid Southwest, where the species are not turf formers, except at an altitude of 5,000 to 7,000 feet, the grama grasses are nevertheless of great importance, including, as they do, species which not only inhabit this region, but which actually furnish the greater part of the feed at altitudes from 7,000 feet down to the driest desert mesas and lowlands. It is a noteworthy fact that the species which produce not only the greatest amount of feed, but the best feed as well, occupy the higher levels. This is of course accounted for by the heavier precipitation.

The conditions upon the highland of Mexico are very much the same as in the southwestern part of the United States, the high tablelands being imperfectly sodded with *Bouteloua gracilis*, *B. chondrosioides*, *B. filiformis*, *B. radicosa*, *B. hirsuta*, etc., and the lower levels producing varying growths of such species as *B. barbata* and *B. aristidoides*. The first group especially includes the main pasture grasses over very large areas.

The species are preeminently pasture grasses and have been so recognized since they were first studied. Lagasca called attention to them in a very positive fashion as early as 1805, and our early explorers were unstinting in their praises of the gramas. It not infrequently occurs, however, that many of the species enter quite largely into the composition of hay. Upon the prairies of the North Central States *B. gracilis*, formerly to a much greater extent than at present, was extensively cut with *Agropyron smithii*, Koeleria, and other prairie species. Farther south, in Nebraska, Kansas, Oklahoma, and northeastern New Mexico, *B. curtipendula* is more conspicuous, and *B. hirsuta* is also of some importance mixed with various species of Andropogon on sandy-loam soils. The most valuable species, however, aside from *B. curtipendula*, do not well adapt themselves to



A. CLOSELY GRAZED BOUTELOUA REGION IN SOUTHERN ARIZONA.



B. HABITAT OF TALL-GROWING SPECIES OF BOUTELOUA IN SOUTHERN ARIZONA.



A. BOUTELOUA CURTIPENDULA (MICHX.) TORR. IN CULTIVATION.



B. BOUTELOUA GRACILIS (H. B. K.) LAG. IN CULTIVATION.

cutting for hay. In the main the nutritious and valuable herbage of the grama grasses consists of their basal leaves, and these grasses are consequently adapted mainly to grazing.

In the main the perennial species very well withstand heavy grazing and the abuses incident to the open range method of handling stock. Indeed, there are few if any grasses that are superior to them in this regard. *Bouteloua gracilis* is the species of prime importance in the prairie region, and, together with *B. chondrosioides*, *B. filiformis*, *B. radicosa*, etc., is also important upon the higher lands farther south. No recorded experiences upon the behavior of these plants under cropping systems in the Southwest are known except the general observation that too close grazing reduces the vitality of the plants, and, if long continued, kills them out entirely (Pl. 68, A). Upon the northern prairies many observations have been made upon the behavior of the prairie grasses when cut for hay. The extent and degree of cropping have been much more definitely observed in the prairie region. In the Dakotas, *Bouteloua gracilis* withstands grazing very well, but if grazed closely for even one season it takes it two or three years to recover. It is the common experience that hay can not be cut on the upland prairies oftener than once every two years. In other words, the removal of the ground cover of one year's growth, as close as the mower takes it, sets the plant back at least one year, while burning is still more detrimental. But this applies to the prairie grasses in general.

ADAPTABILITY TO CULTIVATION.

Many efforts have been made to cultivate the different species of Bouteloua, especially during the grass-garden period of experimentation in this country, from about 1892 to 1900.

The most promising of all the species for field cultivation is *B. curtipendula* (Pl. 69, A), not that it grows any more readily than the others, but on account of its size and habit. All the species respond readily to cultural treatment, but none of them have a good seed habit, a very important characteristic in an agricultural grass. The seed can not easily be even properly thrashed. All that can be done is to strip off the spikes, which separate readily from the panicle upon maturity. The whole spike has been invariably sown. In *B. gracilis* and allied forms the spikelets readily separate from the spikes, but even here it would be impracticable to attempt to secure clean seed.

EXPLANATION OF PLATE 68.—A. A region in which about half a dozen species of Bouteloua grow in profusion whenever summer rains are seasonable, in spite of the fact that it is continuously closely grazed. B. Scene in the Santa Rita Mountains, Arizona. *Bouteloua curtipendula* and tall forms of *B. hirsuta* and *B. radicosa* predominate, mixed with species of Leptochloa, Andropogon, Heteropogon, Muhlenbergia and Panicum.

EXPLANATION OF PLATE 69.—A. *Bouteloua curtipendula*. B. *Bouteloua gracilis*. Both growing at Walla Walla, Washington. Photographs by Leckenby.

The spikes of many of the species also drop off very readily when they approach maturity, and it is thus difficult to save the seed. So pronounced is this tendency in some species that it is impossible to prepare good herbarium specimens of plants in the mature state. This accounts for some of the taxonomic errors that have crept into our conceptions of the species. Collectors have commonly selected plants which could be made into good herbarium specimens, or, having collected mature ones, the spikes have been lost.

Bouteloua gracilis (Pl. 69, B) makes a splendid turf when sown thickly and well cared for. In some places upon the native prairies and foothills of the Northwest beautiful natural turfs of this and Bulbilis are common. Although the quality of the turf is good it has the disadvantage of being green but for a short season.

In short, it is more than probable that, because of the lack of good seed habits in this genus, even the most valuable species can not become of importance in cultivation, although good yields of hay can be secured from *B. curtipendula* at least (Pl. 69, A), and good stands can be secured with any of the other perennial valuable species if the seed be secured and sown thick enough.

DISTRIBUTION.

It is exceedingly difficult to give any definite and concise information regarding the altitudinal distribution of the species. *Bouteloua gracilis* is at home upon the prairies at an altitude of 1,000 feet, and, as we have seen, the same form occurs at 7,000 feet or more in the San Francisco highland of Arizona, and at much lower levels in the Santa Rita Mountains, while the taller form grows as low as 4,000 feet in the Santa Rita Mountains of Arizona. Precipitation is a much more important factor than altitude. So far as temperatures are concerned, *B. gracilis* endures −40° F. in the northern plains and makes a good growth in nearly frostless regions upon the highlands of central Mexico, while it sometimes endures a maximum of 100° F. in the summer season.

In a circumscribed Bouteloua area there is quite a well-marked zonal distribution of some of the species (Pls. 68, B; 70, A, B; 71, A, B). As an example may be mentioned the region north of

EXPLANATION OF PLATE 70.—A. Scene from north of the Santa Rita Mountains in southern Arizona. In the foreground *B. aristidoides* predominates and *B. parryi* is common. A little farther out *B. rothrockii* and *B. filiformis* are the prevailing species. On the lower portion of the steep slopes *B. curtipendula* and *B. hirsuta* are very abundant, the former reaching an altitude of 5,000 feet, about the highest points at the left of the picture. About one-third way up the sides of the mountains to the right *B. radicosa* is abundant, while on southern exposures at the altitude of the small cone in center of picture *B. eludens* occurs sparingly. B. A portion of the same area close to the mountains to the right, as seen in the spring of the year. Compare these with plate 75, B. It will be seen that the crop of grass, mainly Bouteloua, is all eaten off and there is now a crop of annual weedy plants consisting mainly of Plantago, Pectocarya, Eschscholtzia and a few small annual composites.

EXPLANATION OF PLATE 71.—A. A closer view of ground shown in the left-hand part of plate 70, A, showing summer condition of region similar to that shown in plate 70, B. The gramas in the foreground are mainly *B. curtipendula, B. hirsuta, B. filiformis,* and *B. eriopoda. Dasylirion wheeleri* also shows prominently. B. Scene in the Altar Valley, Arizona, Baboquivari Peak in the background. In the foreground are shown *B. rothrockii, B. barbata, B. aristidoides,* and *B. filiformis.*



A. GENERAL VIEW OF A GOOD BOUTELOUA REGION.



B. SPRING VIEW OF A BOUTELOUA REGION CLOSELY GRAZED.



A. TYPICAL VIEW IN A BOUTELOUA REGION, SHOWING A VARIETY OF SPECIES.



B. BOUTELOUA REGION WITH A DIFFERENT SOIL AND DIFFERENT SPECIES.

the highest point of the Santa Rita Mountains of Arizona. From the 4,500 to the 5,000 feet level on the north side of this mountain *B. radicosa* is abundant. From about 4,500 feet down to 3,800 feet *B. filiformis* is commonly the prevailing species. From 3,800 to 3,400 feet *B. rothrockii* is often the most important plant, and it goes here as low as or lower than any of the other perennial species. Throughout this entire range, from 4,500 to about 3,500 feet, *B. curtipendula* may be found, but usually only upon the rougher lands, and it increases in importance upward, becoming the most important species upon the rocky upper foothills at 4,000 feet. *Bouteloua aristidoides*, on the other hand, is of wide distribution and may be found from the upper Bouteloua limit to the lower mesas (Pl. 67, facing p. 343), and even across them clear to the lower Colorado and into the Salton Sink below the level of the sea. Its greatest development is in the lower part of the perennial grass region, about the 3,500 feet level. It is found, in occasional years only, where there is a temporary accumulation of flood water, also in favorable places in the mesas, where the regular annual accumulation commonly produces perennial species of Hilaria. In this general Bouteloua belt, mostly at about 4,000 feet, may be found scattering patches of *B. parryii*, *B. eludens*, and *B. eriopoda*, and, especially below, *B. barbata* is frequently met with.

Roughly speaking, the great Bouteloua region of the world extends from Saskatchewan and Manitoba southward between the Mississippi River and the Continental Divide. The western border crosses the Divide in Wyoming, extends into the southern Great Basin region, and strikes the Pacific coast at about the Mexican boundary. In Mexico the grama grasses extend from coast to coast, reaching their greatest development upon the highland, and disappearing entirely in tropical situations of uniform heavy humidity. They are especially abundant and important in those elevated regions which have a heavy summer precipitation and are comparatively dry the rest of the year. *Bouteloua curtipendula* is common in the eastern United States and *B. hirsuta* is prominent in portions of Florida.

The writer's knowledge of South American species is based entirely upon a study of meager collections which do not warrant any conclusion other than that the species appear to be more or less common in the Cordillera region. A few species are of frequent occurrence in portions of the West Indies and other continental islands.

ILLUSTRATIVE MATERIAL.

Field studies have brought together sufficient material in the group to warrant the distribution of a set of specimens illustrating the writer's conception of the species. These sets, so far as material is available, are deposited in the leading accessible consulting herbaria. A total of nine sets have been put up and deposited as follows:

United States National Herbarium, Washington, D. C.
Gray Herbarium, Cambridge, Mass.
New York Botanical Garden, New York City.
Missouri Botanical Garden, St. Louis, Mo.
Field Museum of Natural History, Chicago, Ill.
University of California, Berkeley, Cal.
Royal Botanic Gardens, Kew, England.
Königlicher Botanischer Garten, Dahlem-Steglitz bei Berlin, Germany.
Muséum d'Histoire Naturélle, Paris, France.

Beginning on page 425 will be found a list of the species which are being thus distributed, together with designation of the sources of the material. The types of the new species here proposed are contained in the set deposited in the United States National Herbarium at Washington. In some cases the numbers are distributed under other names than those of the text because they were arranged before the work on the text was completed.

LIMITATION OF THE GENERA.

The genus Bouteloua [a] was established by Mariano Lagasca in Variedades de Ciencias, Literatura y Artes (Madrid) in 1805. So far as I am able to determine he has expressed in no way what species he considers typical of the genus, although an elaborate discussion is given of the characters and of the economic importance of the group as pasture grasses. Apparently the only way of fixing the type of the genus is to choose the first species listed. This method is as usual the most easily applied in fixing the generic type, and under the application of this rule the name Bouteloua will have to stand for the genus, however that genus is limited, containing the first species, *Bouteloua racemosa* Lag., which is clearly the same species as the earlier described *Chloris curtipendula* Michx. Lagasca wrote another and more comprehensive treatise upon the same genus eleven years later, in which *B. hirsuta* is the first species listed and *B. racemosa* the last. In this treatise Lagasca again fails to indicate what he considers the type of his genus. However, the application to the 1805 paper of this arbitrary principle of priority of place is not here considered to be at all affected by the subsequent publication.

[a] Originally this was written Botelua, although Lagasca states that it is dedicated to two Spanish gardeners, brothers, of the name of Boutelou. In a later paper (Gen. & Sp. Nov. 1816) he adopts the spelling used here.

This is not the method followed in some of the recent literature of the grasses, and it is in no closer accord with recent practice than is the comprehension in one genus of all the species here included. Kunth[a] was the first excessively to divide the group, and to some extent his work has been adopted by some recent authors. Others have contented themselves with adopting Kunth's genera as subgenera or sections. Were I to divide the genus, however, the lines laid down by Kunth would have to be somewhat modified as has been done by Nash.[b] Kunth includes in Dinebra *Bouteloua curtipendula* and *B. aristidoides* as well as *B. radicosa*, *B. repens*, and *B. chondrosioides*, while for *Aristida americana* of Linnæus, the West Indian representative of our *B. filiformis*, which is a variant very close indeed to that species, the monotypic genus Heterostega of Desvaux was adopted. The other monotypic genus, Polyodon H. B. K., should also, without doubt, be included with the *radicosa-repens* section of the genus to which Kunth applied the name Dinebra Jacq. Chondrosium on the contrary is better delimited and could stand on its merits without change better than the others.

Although Kunth formally recognized all these genera it was against his best judgment that this was done. He specifically states that in his opinion these genera should be united. The disposition made here was decided upon before the opinion of Kunth was discovered. His opinion[c] corresponds very closely indeed with my own preference.

There has been much difference of opinion as to the relationship of Cathestecum ever since it was established by Presl.[d] By Bentham and Hooker it was placed in the Zoysieae along with Aegopogon, which closely resembles some species of Bouteloua and probably should stand closer to that genus than it is now placed. By Hackel Cathestecum is included in the Festuceae. But the species of this genus in general aspect as well as in minuter details very closely resemble some species of Bouteloua. The resemblance in the field is so great that botanists usually refer their collections of Cathestecum to Bouteloua.

The group differs from the remainder of the grama grasses in having 3 spikelets in the spike, in the reduction of the first glume in one or all of the spikelets, and in a tendency to multiplication of awns by division of the nerves of the lemma of the upper florets.

[a] H. B. K. Nov. Gen. & Sp. **1**: 171–176. 1816.

[b] Small, Fl. Southeast. U. S. 137. 1903.

[c] H. B. K. Nov. Gen. & Sp. **1**: 173. 1816. The last paragraph on the page reads as follows: "Heterostega vix genus distinctum, habitus Dinebrae, characteres Chondrosii; genera Heterostegae, Chondrosii et Polyodontis, ut mea fert opinio, valde artificialia, et aptius generi Dinebrae conjungenda sunt."

[d] Rel. Haenk. **1**: 295. *pl. 42*. 1830.

Pentarrhaphis, established by Kunth,[a] was based upon *P. scabra*, which remained practically unknown until Hackel and Scribner identified it and added another species in 1890.[b] Since the addition of this second species it is best separated from the other genera by its spikes of 2 spikelets, one of which is aborted in *P. scabra*. There appears to be no other character upon which it can be segregated.

The monotypic genus Triaena[c] is separated by its spikes of a single spikelet. With it will naturally fall *Bouteloua uniflora* when this character alone is considered, but the latter species is manifestly very closely related to *B. curtipendula*. Indeed, it is quite probable that further collections may prove that the former is simply an unusual form of the latter.

BIBLIOGRAPHICAL NOTES.

There has always been a question regarding some of Lagasca's names. Kunth's figures,[d] however, are recognizable by one who is familiar with the species. The examination of a large number of authentic specimens has elucidated many obscure names, but there are a few more that, unless more evidence can be found, will always remain doubtful species.

Cervantes's[e] names published under the genus Erucaria have been rejected almost *in toto*. It would be very desirable to refer these names properly, although it is not probable that they would seriously affect the synonymy.

The next most difficult work to interpret is that of Fournier.[f] Fragments of specimens cited from European herbaria have assisted greatly in settling doubtful questions. The examination of a cited number, however, is not sufficient to identify Fournier's species, for different species are found at times under the same number in different

[a] In H. B. K. Nov. Gen. & Sp. **1**: 178. *pl. 60*. 1816.

[b] Bull. Torrey Club **17**: 233. *pl. 108*. 1890.

[c] H. B. K. Nov. Gen. & Sp. **1**: 178. 1816.

[d] H. B. K. Nov. Gen. & Sp. **1**: *pl. 51–60*. 1816.

[e] La Naturaleza **1**: 347. 1870.

[f] Mex. Pl. **2**: 1881. There is a difference of opinion about the proper date to cite for this work. It seems desirable to bring together here the available facts which appear to be as follows:

1. Fournier read a paper before the Academy of Sciences of Paris, June 10, 1878, in which he stated that this work was completed and in which he gave data regarding the distribution and number of species. (Compt. Rend. Acad. Sci. (Paris) **86**: 1441. 1878.)

2. Bentham received in 1881 a copy marked "proof sheets" (see Hitchcock and Chase, Contr. Nat. Herb. **15**: 49. 1910) with neither index nor title page. (Journ. Linn. Soc. Bot. **19**: 14–134. 1881.)

3. Hackel also received a copy of the work excluding title page and terminating with page 144 (18 sheets) in 1881.

herbaria. The specimens in the herbarium of the Museum of Paris must be taken as the basis of his work, but some of the numbers cited have not been found there and a few have not yet been found elsewhere.

DESCRIPTION OF THE GENERA AND SPECIES.

THE BOUTELOUAE.

Plants annual or perennial, cespitose or stoloniferous, with spikes one to many, mostly several to many, arranged in unilateral racemes, the spikelets mostly nearly sessile in two rows on a flattened rachis which may be simple or forked distally, but so twisted upon their very short peduncles as to appear more or less unilateral especially when young; spikelets mostly 2-flowered, one of the florets rudimentary, in some cases an additional 1 to 3 rudiments; lemmas 3-nerved, 3-awned, with a 2-nerved mostly shorter-awned palet.

KEY TO THE GENERA AND SPECIES.

Spikes consisting of less than 3 spikelets (except in *B. uniflora*).
 Spikes consisting of 1 spikelet; rudimentary spikelet trifid. (TRIAENA, p. 354.)
 Spikes consisting of 2 spikelets, both perfect or 1 rudimentary. (PENTARRHAPHIS, p. 355.)
 One spikelet rudimentary, represented by 2 setæ only 1. *P. scabra.*
 Both spikelets fully developed 2. *P. polymorpha.*
Spikes consisting of 3 or more spikelets.
 Spikes consisting of 3 spikelets. (CATHESTECUM, p. 358.)
 Plants annual 1. *C. prostratum.*

4. Bentham states (loc. cit.) that he is bound to treat it as having taken date, and Hackel used it in the preparation of his part of the grasses in Martius's Flora of Brazil, published July 1, 1883. (Bot. Centralb. **28**: 232. 1886.)

5. Hemsley (Biol. Centr. Amer. Bot. **3**: November, 1885) cites it freely and to the end of the grass volume from the Bentham copy.

6. The copies of Bentham and of Hackel were not galleys nor even page proofs in the ordinary sense, but the signatures in sheets as they came from the press. In other words, the work had taken form and was printed in 1881.

7. Hackel did not receive the index until 1886, although he applied to the printing office for it in 1884. He thinks that the title page was received with the index. (Letter to Hitchcock, Aug. 8, 1906.)

Dr. Barnhart in response to a request for an opinion has, after reviewing the facts, summed up the matter as follows: "(1) Most grass specialists were able to consult Fournier's work from 1881. (2) They regarded it as published (not in a trade sense, but from a botanical standpoint), and cited it accordingly. (3) If we do not accept 1881 as the date, we open the question, in the case of each Fournier name that found its way deviously into botanical literature between 1881 and 1886, whether it was adequately published or not. (4) We have enough questions relating to the adequacy of publication of plant names without needlessly burdening ourselves with such a large number of others. On the whole, therefore, I strongly favor 1881."

Plants perennial.
Plants cespitose..... 2. *C. multifidum.*
Plants stoloniferous.
Spikes dimorphous; sterile lemma cleft less than half way..... 3. *C. erectum.*
Spikes not dimorphous; sterile lemma cleft nearly to the base..... 4. *C. stoloniferum.*

Spikes consisting of more than 3 spikelets. (But including *B. uniflora*, which has but 1 spikelet.) (Bouteloua, p. 363.)
Spikelets pectinately arranged at maturity (Subgenus Chondrosium).
Spikes normally less than 4.
Spike 1.
Plants annual.
Spikes comparatively narrow. (North American)..... 1. *B. procumbens.*
Spikes comparatively wide. (South American)..... 2. *B. simplex.*
Plants perennial.
Stoloniferous..... 3. *B. stolonifera.*
Cespitose..... 4. *B. scorpioides.*
Spikes normally 2, often 1 or 3, or even 4, seldom more than 4.
Glumes tuberculate; rachis prolonged beyond the spikelets as a naked point.[a]
Internodes hirsute-villous..... 5. *B. hirticulmis.*
Internodes not hirsute-villous..... 6. *B. hirsuta.*
Glumes not tuberculate; rachis not prolonged.
Culms annual..... 7. *B. gracilis.*
Culms in part perennial.
Culms erect-branching..... 8. *B. breviseta.*
Culms geniculate-branching..... 9. *B. ramosa.*
Spikes normally 4 or more.
Glumes hairy-villous..... 10. *B. parryi.*
Glumes not hairy-villous.
Plants annual.
Awns of fertile lemma comparatively short..... 11. *B. barbata.*
Awns of fertile lemma comparatively long..... 12. *B. arenosa.*
Plants perennial.
Low, 10 to 30 cm. high.
Rudiment naked..... 13. *B. trinii.*
Rudiment hairy-tufted..... 14. *B. sonorae.*
Larger plants 30 to 50 cm. high.
Culms villous; stoloniferous..... 15. *B. eriopoda.*
Culms not villous; cespitose.
Base delicate..... 16. *B. rothrockii.*
Base strong, harsh, scaly, rhizomatous..... 17. *B. karwinskii.*

[a] Forms of *B. gracilis* have tuberculate glumes, but never a prolonged rachis.

Spikelets not pectinately arranged.[a] (Subgenus ATHEROPOGON.)
Spikes of 1 spikelet 35. *B. uniflora.*
Spikes of more than 1 spikelet.
Plants annual.
Leaves and sheaths tuberculate-hairy 18. *B. alamosana.*
Leaves and sheaths not tuberculate-hairy 19. *B. aristidoides.*
Plants perennial.
Sheaths densely hairy 20. *B. pringlei.*
Sheaths not densely hairy.
Glumes densely hairy.
Sterile lemma trifid, long-awned. 21. *B. chondrosioides.*
Sterile florets two or three, with well developed lemmas (variable) 22. *B. eludens.*
Glumes not densely hairy. (See continuation.)

(Continuation.)
Sterile florets distinctly 2 or more.
Plants stoloniferous 23. *B. megapotamica.*
Plants cespitose.
Plants low, hairy 24. *B. texana.*
Plants tall, smooth 25. *B. lophostachya.*
Sterile floret 1 or with additional rudimentary one.
Second floret trifid and naked, not glumaceous.
Lateral awns short.
Proximal spikelets not rudimentary 26. *B. acuminata.*
Proximal spikelets rudimentary 27. *B. vaneedeni.*
Lateral awns nearly as long as central one 28. *B. americana.*
Second floret glumaceous.
Second floret mostly perfect, the first sterile.
Plants smooth 29. *B. repens.*
Plants more or less prominently papillose-hairy.
Spikes and spikelets alike (Continental America).
Plants stout with harsh rhizomatous base. 30. *B. radicosa.*
Plants more delicate, cespitose or geniculate 31. *B. filiformis.*
Spikes and spikelets very variable (West Indies) 32. *B. heterostega.*
Second floret sterile, the first fertile.
Spikes about 12 33. *B. disticha.*
Spikes more numerous.
Spikelet with rudiment of a third floret 34. *B. pilosa.*
Spikelet with no rudiment of a third floret 36. *B. curtipendula.*

[a] Immature forms of several species belonging here are likely to be looked for under Chondrosium.

TRIAENA H. B. K.

Triaena H. B. K. Nov. Gen. & Sp. **1**: 178. 1816. A monotypic genus based upon *T. racemosa*.

Inflorescence linear, racemose, the spikes arranged in two rows on opposite sides of a flattened axis but so twisted upon their short delicate peduncles as to appear unilateral; spikes consisting of a single 2-flowered spikelet and a prolonged rachis, the lower floret perfect, the upper reduced to a 3-awned rudiment.

1. Triaena juncea (Desv.).

Triathera juncea Desv.; Beauv. Ess. Agrost. 40. *pl. 9. f. 4.* 1812. Beauvois's figures, although diagrammatic, appear to me well to characterize the plant. Desvaux[a] distinguishes this from his *T. americana* which is *Aristida americana L.*

Triaena racemosa H. B. K. Nov. Gen. & Sp. **1**: 179. *pl. 61.* 1816. Easily identified from the figures and description. See also Roem. & Schult. Syst. Veg. **2**: 421. 1817.

Eutriana triaena Trin. Gram. Unifl. 239. 1824. Based upon *Triaena racemosa* H. B. K.

Atheropogon triaena Spreng. Syst. Veg. **1**: 293. 1825. Based upon *Triaena racemosa* H. B. K.

Atheropogon domingensis Spreng. Syst. Veg. **1**: 293. 1825. Based upon *Triathera juncea* Desv.

Dineba cristata Presl, Rel. Haenk. **1**: 293. 1830. The type, in the Bohemian National Museum at Prague, has been examined.

Triathera racemosa Desv. Opusc. 72. 1831. Based on *Triaena racemosa* H. B. K. See also Roem. & Schult. Syst. Veg. **2**: 421. 1817; Fourn. Mex. Pl. **2**: 141. 1881.

Eutriana? cristata Kunth, Enum. Pl. **1**: 281. 1833. Based upon *Dineba cristata* Presl.

Triathera gracilis Fourn. Mex. Pl. **2**: 141. 1881. I have no hesitancy in referring this to *Triaena juncea*, although Fournier says distinctly that his plant is not *Triaena racemosa* H. B. K. Fournier cites "*Eutriana racemosa* Trin. Msc. in Herb. Petrop." as a synonym. All specimens so named by Trinius belong to *Bouteloua curtipendula*. The first specimen cited by Fournier is Berlandier's no. 1016 from Cuernavaca, Mexico. This number in the herbarium of the Muséum at Paris, as well as in the herbarium at Vienna, belongs here without doubt. The latter is labeled *Eutriana racemosa* Trin. (See *Eutriana racemosa* Trin.)

Bouteloua triaena Scribn. Proc. Acad. Phila. **1891**: 307. *f. 2.*[b] 1891. Based upon *Triaena racemosa* H. B. K. See also Bull. Torrey Club **18**: 314. 1891.

DESCRIPTION.

A cespitose, erect, sparingly hairy perennial, forming strong, conspicuous bunches among other grasses or more rarely continuous pure growths approaching a rough, bunchy turf; culms sparingly branched, erect or when luxuriant geniculate, 40 to 50 cm. high; sheaths rather close, striate, covered with long, scattered, papillose hairs, these more numerous in plants of exposed places; blades narrow, comparatively short, the lower about 7 cm., the upper 5 cm. long, erect, acuminate, rigid, involute, smooth save for the regularly arranged, marginal, papillose hairs; panicle slender, racemose, 7 to 10 cm. long, the spikes bilateral but usually so curved on their peduncles as to appear unilateral; spikes variable in number, 20 to 70, about 7 mm. long at anthesis but becoming 10 to 12 mm. long by the development of the awns of the rudiment,

[a] Journ. de Bot. **1**: 67. 1813.

[b] In Beal's Grasses of North America (**2**: 427. 1896) this figure is incorrectly transferred to *B. texana*.

consisting of one spikelet, the rachis prolonged 1 to 2 mm. beyond; spikelet 2-flowered, the lower floret perfect, the upper reduced to a 3-awned rudiment; glumes minutely hispidulous on the keel, acuminate, the first 2 to 3 mm., the second 4 to 5 mm. long, very short-awned or merely acuminate; lemma ovate, indistinctly 3-nerved, especially below, 3-toothed at the apex, rarely awned; palet 2-nerved with 2 short awns at the apex; rudiment consisting of 3 scabrous awns about 7 mm. long, upon a naked stipe 3 mm. long; caryopsis not seen. (FIGURE 19.)

This species is common upon the highlands of central Mexico, especially from Hidalgo to Oaxaca, and extends far into Guerrero and western Jalisco. It is well represented in herbaria by *Pringle* 7482, 870, and 9573, and *Nelson* 1842, which are typical. Miguel Bang's no. 1307 in Plantae Bolivianae, from Sorata, Bolivia (distributed by Britton and Rusby), and Schop's no. 740 are both immature. The latter probably belongs here, but the former is doubtfully referred to this species.

HERBARIUM SPECIMENS.

MEXICO: *Pringle* 9573, El Salto; 8708, near Jojutla; 4792, Los Sedas, Oaxaca. *Nelson* 1842, Dominguillo; 1542, Valley of Oaxaca. *Conzatti & Gonzalez* 265, Los Sedas. *Schott* 740, Yucatan.

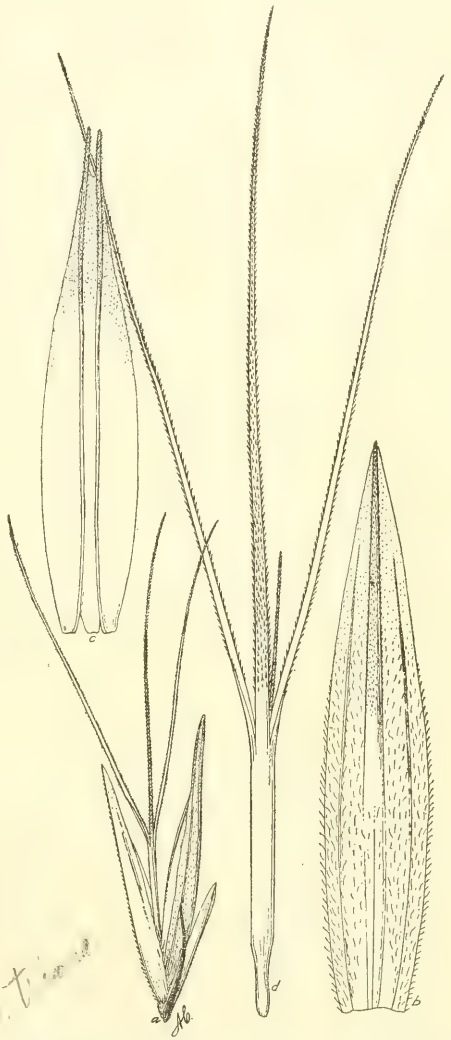


FIG. 19.—*Triaena juncea*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, rudiment. *a*, Scale 5; *b–d*, scale 10. From *Griffiths* 8122.

PENTARRHAPHIS H. B. K.

Pentarrhaphis H. B. K. Nov. Gen. & Sp. 1: 177. *pl. 60.* 1816. A monotypic genus based upon *P. scabra*.

Polyschistis Presl, Rel. Haenk. 1: 294. *pl. 41. f. 12-18.* 1830. Based upon *P. paupercula*.

Strombodurus Willd.; Steud. Nom. Bot. ed. 2. 2: 299. 1841. This is listed as a synonym of Pentarrhaphis, and the single species *S. gracilis* Willd. is referred (page 647) to *Pentarrhaphis scabra* H. B. K. (The initial letter of the latter generic name is misprinted "D".)

Species with small, woolly spikes consisting of 2 spikelets, one of these sometimes aborted, approximate on a rachis ending in a forked or bifid prolongation; first glume of each spikelet reduced to scarcely more than a straight awn; these together with the bifid rachis appearing like a cluster of awns at the base of the spikelet; spikelets 2-flowered.

1. Pentarrhaphis scabra H. B. K.

Pentarrhaphis scabra H. B. K. Nov. Gen. & Sp. **1**: 178. *pl. 60.* 1816. Authentic material has not been found, but the figures are good and leave no room for doubt as to the identity of the species. See also Bull. Torrey Club **17**: 233. *pl. 108.* 1890.

Atheropogon pentarrhaphis Spreng. Syst. Veg. **1**: 294. 1825. Based upon *Pentarrhaphis scabra* H. B. K.

Eutriana pentarrhaphis Trin. Gram. Unifl. 239. 1824. Based upon *Pentarrhaphis scabra* H. B. K.

Polyschistis paupercula Presl,[a] Rel. Haenk. **1**: 294. *pl. 41. f. 12–18.* 1830. The figures and description identify the plant.

DESCRIPTION.

An erect, cespitose perennial about 30 cm. high; culms erect, commonly branched from the upper nodes; sheaths loose, striate, the ligule a short, dense fringe of white

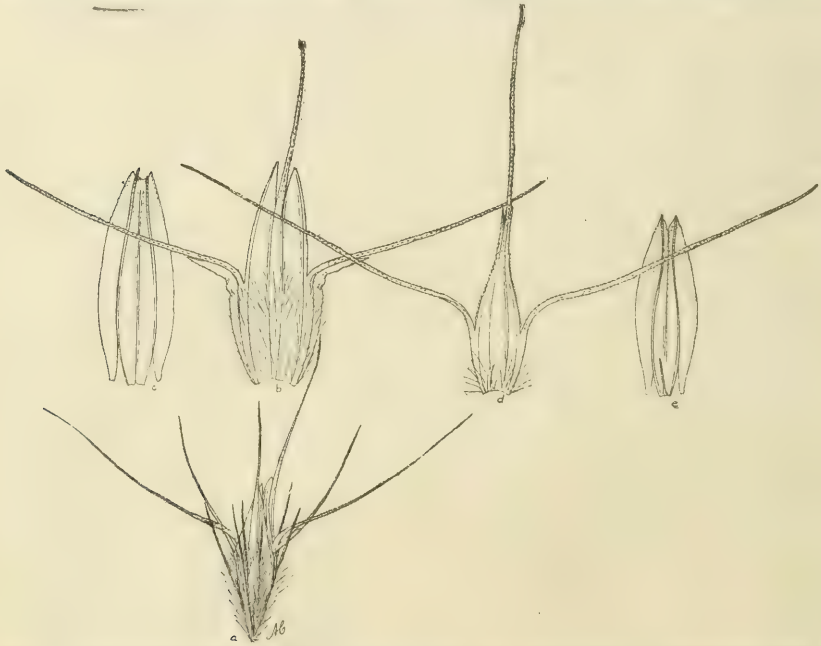


FIG. 20.—*Pentarrhaphis scabra.* *a*, Spike; *b*, *c*, lemma and palet of first floret; *d*, *e*, lemma and palet of second floret. *a*, Scale 5; *b–e*, scale 10. From *Heyde & Lux* 4659.

hairs; blades mostly radical, rather harsh, rigid, very slightly scabrous on the margin, the lower 4 to 5 cm. long, the upper reduced to 2 cm. long or less; panicle racemose, loose, 4 to 5 cm. long, the rachis zigzag; spikes about 12, small, 8 mm. long, including the awns, consisting of one perfect, 2-flowered spikelet and a cluster of awns below; cluster of awns consisting of 5 parts, 2 of these united below, representing the continuation of the rachis, one slightly expanded, representing the first glume of the perfect spikelet, the other two representing the aborted lower spikelet, all of these, together with the upper glume, densely white-hairy; lemma of the first floret, including awns, about 6 mm. long and of the second floret about 7 mm. long, both sparingly hairy, the upper coriaceous; palet slightly scabrous on the nerves, convolute, nearly 3 mm. long, scarcely awned; caryopsis not seen. (FIGURE 20.)

[a] This is from tropical America instead of the Island of Luzon, as stated by Presl. See Merrill's opinion in the Philippine Journal of Science (**1**: 380. 1906).

HERBARIUM SPECIMENS.

MEXICO: *Nelson* 2940, Chiapas.
GUATEMALA: *Heyde & Lux* 423, Santa Rosa.

2. Pentarrhaphis polymorpha (Fourn.).

Atheropogon polymorphus Fourn. Mex. Pl. **2**: 141. 1881. A few spikes of the type before me identify this plant perfectly. Fournier had smaller plants, however, than any in the U. S. National Herbarium, as indicated by a photograph of the specimens in the herbarium of the Muséum at Paris.

Bouteloua fourneriana Vasey; Wats. Proc. Amer. Acad. **22**: 461. 1887. A name only.

Pentarrhaphis fourneriana Hack. & Scribn. Bull. Torrey Club **17**: 229. *pl. 107, 108.* 1890. Pringle's no. 2559 in U. S. National Herbarium is a duplicate of the type.

Pentarrhaphis geminata Hack. & Scribn. Bull. Torrey Club **17**: 230. 1890. A name only.

DESCRIPTION.

An erect, smooth, cespitose perennial, about 30 cm. high, with the habit of well-developed plants of *B. trinii*, but larger throughout; culms mostly erect, but in some



FIG. 21.—*Pentarrhaphis polymorpha.* *a*, Spike displayed; *b*, *c*, lemma and palet of first floret; *d*, *e*, lemma and palet of second floret. *a*, Scale 5; *b–e*, scale 7.5. From *Pringle* 2559.

specimens inclined to be slightly geniculate; upper blades sparse, flat, and short, the lower more abundant and longer, 5 to 10 cm. long and about 1 mm. wide, bearing a few minute, scattered hairs on both surfaces; sheaths striate, smooth, narrow, the ligule reduced to a ciliate fringe; panicle racemose, the rachis wavy or zigzag; spikes 4 to 8, triangular, 6 to 10 mm. long, purplish in all the specimens at hand; spikelets with backs together, 2-flowered, the lower floret pistillate, the upper staminate, with a bifid or undivided awn-like rudiment of a third; glumes narrow, the lower reduced to little more than an awn about 4 mm. long, the upper wider, keeled, notched above, 5 to 6 mm. long; lemma 5 to 6 mm. long, including the 3 nearly equal awns, the glumes and lower lemma covered with white hairs 1 mm. long; palet 3 to 4 mm. long, deeply

cleft and bearing 2 short awns; palet and upper floret smooth; behind the palet of the upper floret, a short awn, 1 mm. long, the prolongation of the rachilla; caryopsis not seen. (FIGURE 21.)

The species has not often been collected. In the U. S. National Herbarium, *Pringle* 2559, 11242, 5398, and *Palmer* 200, all from the State of Jalisco, Mexico, are representative. Palmer has also collected it near Durango, Mexico. Rose's no. 1621, Sinaloa, and *Rose & Hough* 4775, Jalisco, are typical.



FIG. 22.—*Cathestecum prostratum.* *a*, Sheath with inflorescence protruding, showing two spikes, one with 3 spikelets, the other with the lower pair of spikelets aborted; *b*, uppermost spikelet; *c*, *d*, lemma and palet of first floret; *e*, *f*, lemma and palet of second floret; *g*, *h*, lemma and palet of third floret; *i*, lemma of fourth floret; *j*, one of lower pair of spikelets; *k*, *l*, lemma and palet of first floret; *m*, *n*, lemma and palet of second floret. *a*, Scale 5; *b*–*n*, scale 7.5. From type specimen.

CATHESTECUM Presl.

Cathestecum Presl, Rel. Haenk. 1: 294. *pl. 42.* 1830. Based upon *C. prostratum*. Bentham and Hooker[a] write the name "Cathestechum."

Inflorescence racemose, with 4 to many spikes, each consisting of 3 approximate spikelets, the first glume of each spikelet, or at least of the terminal one, more or less reduced, commonly to a nerveless fimbriate scale, the lemmas of the upper florets showing a tendency toward branching, or sometimes an actual multiplication of nerves and awns by division of the typical lateral nerves.

[a] Gen. Pl. 3: 1122. 1883.

1. Cathestecum prostratum Presl.

Cathestecum prostratum Presl, Rel. Haenk. **1**: 295. *pl. 42*. 1830; Steud. Syn. Pl. Glum. **1**: 201. 1854; Fourn. Mex. Pl. **2**: 133. 1881; Hemsl. Biol. Centr. Amer. Bot. **3**: 517. 1885. The following set of characters is drawn from a panicle of the type before me: Spikes 4 to 6, small, about 2.5 mm. wide and 4 mm. long, or, including the awns of the upper spikelets, 8 mm. long, the rachis prolonged into a bifid awn 2 mm. long, the lower pair of spikelets always aborted and often reduced to little more than the glumes, always short-awned; third spikelet, 2-flowered, with a rudimentary third floret, the first floret pistillate; glumes narrow, awned, densely hairy, the first one of the third floret reduced to a blunt, comparatively wide, nerveless scale less than 1 mm. in length; lemma of third spikelet about 4 mm. long, including the slightly unequal awns, slightly hairy above, with subulate acute lobes; palet



FIG. 23.—*Cathestecum prostratum*. *a*, Spike; *b*, uppermost spikelet and prolongation of rachis; *c*, *d*, lemma and palet of first floret; *e*, *f*, lemma and palet of second floret; *g*, *h*, lemma and palet of third floret with prolongation of rachilla attached; *i*, one of lower pair of spikelets; *j*, *k*, lemma and palet of first floret; *l*, *m*, lemma and palet of second floret. *a*, Scale 5; *b–m*, scale 7.5. From *Pringle* 8707.

2-nerved, with edges incurved, scarcely awned; lemmas of second floret and rudiment of third, with longer, more prominently hirsute awns and rounded, very deeply divided lobes.

DESCRIPTION.

A tufted annual, about 20 cm. high; culms variable, erect, geniculate or half-prostrate, branching at the nodes; sheaths loosely inclosing the main culm and its branches, the ligule reduced to a delicate fringe of flexuous, white hairs; blades few, short, 3 to 5 cm. long, 1.5 mm. wide, the upper subulate, about 1 cm. long; panicle loosely racemose, with a zigzag flattened axis about 3 cm. long; spikes 4 to 8, triangular rhomboidal, about 8 mm. long; lower or lateral spikelets about 4 mm. long, the central or upper one about 6 mm. long, the two lateral 2-flowered and apparently both always staminate, the upper central spikelet consisting of one lower pistillate and two upper staminate florets and a club-shaped or bifurcated prolongation of the rachilla, about 1 mm. long, behind the palet of the third floret; second glume of each

spikelet densely covered with long straight hairs, that of each lateral spikelet about 3 mm. and of the upper one about 4 mm. long, the first glume of each lateral spikelet less hairy and only 2 mm. long, that of the upper spikelet reduced to a broad fan-shaped, nerveless scale scarcely 1 mm. in length; lemmas of the lower spikelets sparsely short-hairy, coriaceous, 2 to 3 mm. long, short-awned; palets convolute, 2-nerved, slightly scabrous at the tip, not awned; awns of palet of third spikelet about 2 mm. long and more scabrous, the parts of the third floret much reduced; caryopsis not seen. (FIGURES 22, 23.)

The above description is drawn from Pringle's no 8707, upon which the large spikes are by far the most abundant, but upon the same specimens there are other spikes which are the same as those of the type.

The Haenke specimen is uniform in having small spikes with the lateral spikelets more or less aborted. The Pringle specimen, on the contrary, shows the species to be dimorphic.

Fournier refers one of Schaffner's specimens without locality to this species, but I have seen only the fragment of the type mentioned above and *Pringle* 8707, collected on limestone hills near Jojutla, Morelos, Mexico.

It is more than likely that the description will have to be modified somewhat in the future, for all specimens seen are immature.



FIG. 24.—*Cathestecum multifidum*. *a*, Spike; *b*, uppermost spikelet; *c*, *d*, lemma and palet of first floret; *e*, *f*, lemmas of second and third florets; *g*, *h*, two views of caryopsis; *i*, one of lower pair of spikelets; *j*, *k*, lemma and palet of lower floret. *a*, Scale 5; *b–f*, scale 7.5; *g–i*, scale 10; *j*, *k*, scale 7.5. From type specimen.

2. Cathestecum multifidum sp. nov.

DESCRIPTION.

A delicate, upright, hairy, cespitose perennial, about 40 cm. high; culms erect, delicate, simple; sheaths striate, close, with a few scattered hairs above; ligule a fringe of a few long white hairs; blades abundant below, flat, long and narrow, 10 to 15 cm. long, a trifle over 1 mm. wide, the upper reduced, thinly beset with long, straight or flexuous, white hairs, 2 to 3 mm. long, arising from papillæ; panicle racemose, 5 to 6 cm. long, on a zigzag axis; spikes about 15, small, 4 to 5 mm. long over all, roughly triangular in outline, the rachis prolonged as a barbed, simple or bifid awn, usually less than 2 mm. long, with or without a very small winged expansion on one side; lateral spikelets 2-flowered, the rachilla prolonged into a blunt or bifid awn behind the palet of the second floret, or often the upper floret aborted and reduced to a bunch of awns upon a naked stipe; central spikelet 2-flowered, with a well-developed third floret consisting of 6 to 10 expanded awns on a naked stipe; glumes pubescent, narrow, acuminate or short-awned, the first about 2 mm. long, the upper about 3 mm. long; lemma of the lower floret about 2.5 mm. long over all, bearing a few scattered hairs, 3-nerved, 3-awned, the awns very short; palet plicate, about 2.5 mm. long, scarcely awned; lemma of the second floret becoming 5 to 7-awned by the splitting of each of the normal lateral nerves into 2 or 3, 3 to 5 mm. long; lower floret of upper spikelet apparently pistillate only, the others staminate; caryopsis not seen. (FIGURE 24.)

The type of this species was collected by myself at Iguala, Mexico, September 9, 1909. It was later collected at Oaxaca, Mexico, by Hitchcock (no. 6164). It is an

abundant and conspicuous plant, easily recognized by its long, delicate, graceful culms, small spikes, tufted habit and narrow, flat, hairy, abundant leafage. In minuter details it differs from all other species of the genus in having the lateral awns of the lemmas of the second floret split into 2, making a well-developed 5-awned lemma, while the lower florets are typically 3-awned, and the lateral awns of the lemma of the third floret and rarely of the second also are split into 3, making it 7-awned and 7-nerved.

It is very probable that this characterization will have to be modified when mature material becomes available, for the above collections are of plants in bloom only.

3. Cathestecum erectum Vasey & Hack.

Cathestecum erectum Vasey & Hack. Bull. Torrey Club **11**: 37. *pl. 45.* 1884. The Havard specimens from Presidio County, western Texas, no. 30, 1881, and no. 2, 1883, are in the U. S. National Herbarium, together with the Palmer specimen from Sonora, Mexico, 1869, which is the first mentioned. There is a note on Havard's no. 30 in

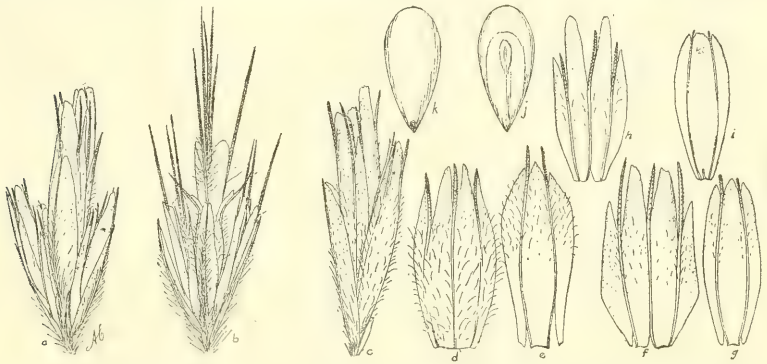


FIG. 25.—*Cathestecum erectum.* *a*, *b*, Short and long-awned forms of spikelet; *c*, uppermost spikelet of *a*; *d*, *e*, lemma and palet of first floret; *f*, *g*, lemma and palet of second floret; *h*, *i*, lemma and palet of third floret; *j*, *k*, two views of caryopsis. *a*, *b*, Scale 5; *c–i*, scale 7.5; *j*, *k*, scale 10. From *Griffiths* 6834.

Vasey's hand, "=17 Dr. Palmer 1869." See also U. S. Dept. Agr. Div. Bot. Bull. **12**[1]: *pl. 13.* 1890; Contr. Nat. Herb. **2**: 536. 1894.

This is the species described and figured[a] by Scribner under the name *Cathestecum prostratum* Presl.

DESCRIPTION.

A sparsely hairy, erect, stoloniferous perennial of variable habit, 5 to 40 cm. high; culms erect or geniculate and rooting at the prominently hairy nodes, simple or branched; sheaths sparsely hairy, the ligule a line of long white hairs; blades flat, very variable, abundant below, shortened upward, bearing a few scattered hairs like those on the sheaths, scabrous-margined; panicle racemose, 3 to 5 cm. long, the apex of the axis minutely bifurcated; spikes 6 to 8, about 8 mm. long, rather thin, but not especially lax; the upper spikelet perfect, the lateral pair rudimentary; lower florets of the lateral spikelets with well developed but sterile lemmas; second floret staminate or neuter, the upper rudimentary; first glume of each spikelet reduced to a short, truncate, nerveless scale, the second long, lanceolate, keeled, hairy, mucronate, 3 to 4 mm. long; lemma coriaceous, smooth, with awns and lobes about equal, but the awns slightly longer, in the upper florets the lobes deeper and the awns with long hairs below; palet slightly shorter than the fertile lemma, plicate, short-awned; caryopsis obovate, 1.5 mm. long, flattened, the scutellum covering about three-fourths the ventral surface. (FIGURE 25.)

[a] U. S. Dept. Agr. Div. Agrost. Bull. 7: 242. *f. 224.* 1897.

The above characterization is drawn from the short-awned form which corresponds with the type.

This species is variable. Hitchcock's no. 6776 from Balsas, Mexico, is very different in color, especially from the northern Sonora plants.

In 1904 between Imuris and Santa Ana in the State of Sonora I collected under no. 6834 two more or less distinct forms. One, which grew in a favorable depression, is tall and rank, with abundant leafage, and is short-awned. The other, which grew on a contiguous gravelly knoll, shows both short and long-awned forms, but on separate plants.

Collections have commonly included both forms under the same number. But one thing is peculiar—the two forms are seldom found on the same plant. Both forms produce seed and in exactly the same relative position. Pringle's no. 4559 contains both forms, but the long-awned one has the spikes greatly reduced, the two lower spikelets being very much aborted. Palmer's nos. 1261 of 1891 and 705 of 1890 show both forms also. Not until Hitchcock's 1910 collections from Mexico came in were the two forms found on the same plant. This does not appear to be a case of lengthening of the awns after anthesis, as with *Bouteloua chondrosioides*, but a true dimorphic character. The species is distributed from the Rio Grande region of western Texas to Arizona and southward to the state of Colima.

Palmer's no. 345 of 1887 from Guaymas, Mexico, has a habit which is unique. The culms instead of being geniculate-stoloniferous are erect-proliferous with the same knotty appearance at the nodes, but perfectly erect and not rooting.

HERBARIUM SPECIMENS.

TEXAS: *Havard* 30, and 2, El Paso to Presidio. *Nealley*, Chenata.

MEXICO: *Palmer* 18, Yaqui River, Sonora; 345, 161, Guaymas; 66, Chihuahua; 270, Guadalajara; 126, 112, Colima; 705, Alamos; 1460, 1459, Ymala. *Pringle* 597, Altar; 4559, Tequila. *Hitchcock* 3528, Llano. *Brandegee* 1, 2, Culiacan.

4. Cathestecum stoloniferum (Fourn.).

Atheropogon stolonifer Fourn. Mex. Pl. 2: 140. 1881. The type is *Liebmann* 588, "La Parada, Sierra de Oajaca." As this specimen has not been examined, the description and cited locality are our only guide. The name is appropriate and the description fits the plants referred here. Fournier's characterization of spike details, however, is not so satisfactory.

= Pringleochloa stolonifera (Fourn.) Scribn.

DESCRIPTION.

A low, creeping, stoloniferous perennial, 10 to 15 cm. high, forming at times a moderate turf; culms erect or geniculate, 10 to 15 cm. high, with stolons rooting readily and bearing small tufts of leaves at intervals of 8 to 10 cm.; sheaths short, striate, smooth, the nodes smooth except when geniculate and then hairy, the ligule consisting of a few, long, white hairs; spikes 4 to 6, triangular in general outline and about 13 mm. long; first floret pistillate, the second staminate, with or without one or two rudimentary additional ones, the latter always more numerous and better developed in the upper central spikelet; glumes of lower spikelets densely hairy, narrow, keeled, acuminate, short-awned, the lower more than 2 mm., the upper more than 4 mm. long, the lower glume of the upper spikelet reduced to a nerveless fan-shaped, fimbriate scale scarcely 1 mm. long; lemma of the lower floret coriaceous, pubescent, about 6 mm. long including the awns; central awn about 2 mm. longer than the lateral; lateral awns of the lower spikelets often unequal in the second floret,

the third floret when present bearing equal awns, the lemma being very deeply lobed and cut, the lateral awns appearing almost separated; palet plicate, very shortly 2-awned; caryopsis obovate, 1.5 to 2 mm. long, with conspicuous embryo and scutellum covering practically the entire ventral surface. (FIGURE 26.)

The species is very abundant in the canyon of Tomellín, where it constitutes the main pasturage over extensive areas and whence it extends to the valley of Oaxaca. It makes a semblance of a turf in places and in habit very closely resembles *Hilaria cenchroides*.



FIG. 26.—*Cathestecum stoloniferum*. *a*, Uppermost spikelet; *b*, *c*, lemma and palet of first floret; *d*, *e*, lemma and palet of second floret; *f*, *g*, lemma and palet of third floret; *h*, *i*, lemma and palet of fourth floret; *j*, *k*, two views of caryopsis; *l*, one of lower pair of spikelets. *a–i*, Scale 7.5; *j*, *k*, scale 10; *l*, scale 7.5. From *Griffiths* 8122.

The only specimen referred here, aside from collections by myself and Hitchcock listed elsewhere,[a] is no. 958, collected by C. L. Smith at San Antonio, valley of Oaxaca, Mexico.

BOUTELOUA Lag.

Botelua Lag. Var. Cienc. **2**[4]: 134. 1805. Based upon *B. racemosa*.

Atheropogon Muhl.; Willd. Sp. Pl. **4**: 937. 1806. Based upon *A. apludioides*.

Triathera Desv. Nouv. Bull. Soc. Philom. Paris **2**: 188. 1810. Based on *Aristida americana*.

Heterosteca Desv. Nouv. Bull. Soc. Philom. Paris **2**: 188. 1810. Based upon *H. juncifolia* from "Antillis." See also H. B. K. Nov. Gen. & Sp. **1**: 173. *pl. 54*. 1816. The name is written by Kunth[b] "Heterostega," and by Hooker[c] "Heterostegon."

[a] See page 425.

[b] Mém. Mus. Hist. Nat. **2**: 73. 1815.

[c] Trans. Linn. Soc. Bot. **20**: 175. 1847.

Chondrosium Desv. Nouv. Bull. Soc. Philom. Paris **2**: 188. 1810. Based upon *Chloris procumbens* Durand.

Actinochloa Willd.; Beauv. Ess. Agrost. 41. 1812. "*A. tenuis* Willd. manuscript" mentioned as a synonym of Chondrosium. See also Roem. & Schult. Syst. Veg. **2**: 417. 1817. Based upon *Chondrosium procumbens* Desv.

Dineba Beauv. Ess. Agrost. 98. 1812. In listing the genera in which the species of his proposed genus have been placed Beauvois gives after "*Dineba* DELIL.," Aristida first and without doubt had in mind *A. americana* L. In listing the species he places "*D. arabica* (*Cynosurus retroflexus* ? Lin.)" first and "*Aristida americana* Lin.," following. In his illustrations he gives *D. curtipendula* first, followed by *D. arabica* and *D. americana*. Delile [a] figures under *D. aegyptiaca* the same plant as does Beauvois under *D. arabica*. But this species does not belong to this group. (See list of excluded names, p. 423.)

Polyodon H. B. K. Nov. Gen. & Sp. **1**: 174. *pl. 55.* 1816. This is a monotypic genus based upon *P. distichum.*

Eutriana Trin. Fund. Agrost. 161. 1820. Based upon *Chloris curtipendula* Michx.

Aristidium (Endl.) Lindl. Veg. Kingd. 116. 1846. *Eutriana*, section Aristidium Endl., [b] based on *Dinebra aristidoides* H. B. K. (misspelled "aristoides"), is listed as a genus by Lindley.

Triplathera (Endl.) Lindl. Veg. Kingd. 116. 1846. *Eutriana*, section Triplathera Endl., [c] based on *Eutriana multiseta*, is listed as a genus by Lindley.

Antichloa Sweet; Steud. Nom. Bot. ed. 2. **1**: 108. 1840. The same as "Actinochloa"; a name only.

Nestlera Willd.; Steud. Nom. Bot. ed. 2. **2**: 192. 1841. Based upon *N. festucaeformis* of Willdenow Herbarium, which is *Bouteloua bromoides*, i. e., *B. radicosa*, accord ing to the Index Kewensis; names only.

Erucaria Cervantes, La Naturaleza (Mexico) 347. 1870. (See list of excluded names, p. 424.)

"*Chondrosia* or *Chondrosium* Desv.;" Benth. Journ. Linn. Soc. Bot. **19**: 104. 1881. Simply a discussion of the general divisions of the group and a mention of *Bouteloua racemosa* Lag. as the best-known species.

Very variable in every detail; spikes one to 60; spikelets more than 3, [d] pectinate or not, 2 to several-flowered, mostly 1-flowered, with one or more rudiments; the lemmas 3-nerved, 3-awned, the palets 2-nerved, 2-awned.

1. Bouteloua procumbens (Durand).

Chloris procumbens Durand, Chlor. Sp. 1808. I am able to verify the opinions of some of the older authors from a copy of the original description kindly furnished by the Director of the Kew Gardens.

Chondrosium procumbens Desv. in Beauv. Ess. Agrost. 41. *pl. 9. f. 7.* 1812. Based on "*Chloridis spec.* DURAND." Desvaux [e] also gives this, the only species, under his genus Chondrosium, with *Chloris procumbens* Durand as a synonym.

Atheropogon procumbens Jacq. Eclog. Gram. 16. *pl. 12.* 1813. (Copy in Gray Herbarium.) The illustrations and description are good. *Chloris procumbens* Durand is cited as a synonym.

Boutcloua prostrata Lag. Gen. & Sp. Nov. 5. 1816. A specimen from Lagasca in the herbarium at Munich appears to belong here, but the single culm before me has two spikes, which is the unusual form of the species. Lagasca listed this species

[a] Descr. Egypte 26. *pl. 11. f. 3.* 1813.

[b] Gen. Pl. 94. 1836.

[c] Trans. Linn. Soc. Bot. 20: 175. 1847.

[d] An exception is found in *B. uniflora* which has one spikelet in a spike.

[e] Journ. de Bot. **1**: 69. 1813.

without description in an earlier[a] paper. See also U. S. Dept. Agr. Div. Bot. Bull. **12**[1]: *pl. 42*. 1890.

Chondrosium tenue Willd.; Beauv. Ess. Agrost. 158. 1812. Beauvois publishes "*Actinochloa tenuis* Willd. mss." on page 41 and makes the above combination in his index on page 158. He, however, gives no description. In his private copy of the above-cited work he has written " = Bouteloua simplex Lag. and Actinochloa, Roemer." See also H. B. K. Nov. Gen. & Sp. **1**: 176. *pl. 57*. 1816. Plainly distinguishable by the figure and description.

Actinochloa procumbens Roem. & Schult. Syst. Veg. **2**: 417. 1817. Based upon *Chloris procumbens*.

Actinochloa tenuis Willd.; Roem. & Schult. Syst. Veg. **2**: 418. 1817. *Chondrosium tenue* H. B. K. is cited as a synonym.

Actinochloa prostrata Roem. & Schult. Syst. Veg. **2**: 419. 1817. Based upon *Bouteloua prostrata*.

Eutriana tenuis Trin. Gram. Unifl. 240. 1824. Based upon *Actinochloa tenuis* Willd.

Chloris filiformis Poir.; Kunth, Rév. Gram. **1**: 93. 1829. Mentioned as a synonym of *Chondrosium tenue*.

Chloris tenuis Poir.; Kunth, Rév. Gram. **1**: 93. 1829. A herbarium name cited as synonym of *Chondrosium tenue*.

Chondrosium? prostratum Kunth, Rév. Gram. **1**: 94. 1829. Based upon *Bouteloua prostrata* Lag. See also Sweet. Hort. Brit. **1**: 455. 1826; Fourn. Mex. Pl. **2**: 138. 1881.

Bouteloua tenuis Griseb. Abh. Ges. Wiss. Göttingen **19**: 211. 1874. (Plantae Lorentzianae.) Based upon *Chondrosium tenue*.

Bouteloua pusilla Vasey, Bull. Torrey Club **11**: 6. 1884. The type, in the National Herbarium, was collected by Vasey at Kingman, New Mexico, June, 1881.

DESCRIPTION.

A small, smooth, cespitose, prostrate or ascending, sparingly branched, annual, attaining its best development above an altitude of 1,600 meters; sheaths smooth, striate, with reduced, shortly pubescent ligules and few narrow blades only 2 to 3 cm. long; spikes solitary, 1.5 to 2 cm. long, revolute toward maturity, fertile to the end of the rachis; spikelets consisting of one lower fertile floret and an upper rudiment; glumes keeled, acuminate, pointed but awnless, the first smooth, about 3 mm. long, the second minutely hispid on the keel and 4 to 5 mm. long; lemma broadly oval, with 3 hispid, unequal awns, the central the longest and expanded with wing-like projections below; palet broadly obovate, smooth, broadly rounded above, about 3 mm. long, rudiment consisting of 3 equal, hispid awns, about 4 mm. long, together with 2 or 3 very small scales upon a naked stipe bearing a tuft of white hairs at its apex; caryopsis about 2 mm. long, 0.75 mm. wide, obovate, the scutellum covering the entire ventral and curving back over a portion of the dorsal surface. (FIGURE 27.)

When thinly distributed, especially upon loose fertile soils, this species forms large bunches which are more likely to be prostrate than when the plants are crowded and smaller.

As a forage plant it is of very little value on account of its diminutive size and the ease with which it pulls up when grazed. Indeed, it has never been met with in sufficient abundance to be much of a factor in feed production.

Specimens representing my conception of the species are *Pringle* 6450, 11218, *Palmer* 176, 332, 503, 712, *Metcalfe* 583. *Pringle* 1434, Chihuahua, and 6450, Federal District of Mexico, and *Schaffner* 156, San Luis Potosí, approach the heavy-spiked

[a] Var. Cienc. **2**[4]: 141. 1805.

form of South America treated as *B. simplex*. Indeed, the last is almost a perfect match for some of the South American forms. The species has a very wide distribution, extending from Colorado southward, its place being taken by *B. simplex* in South America, if indeed the latter is distinct.



FIG. 27.—*Bouteloua procumbens*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, rudiment of second floret; *e*, rudiment of third floret; *f*, three views and cross section of caryopsis. *a*, Scale 7.5; *b–f*, scale 12.5. From *Griffiths* 7362.

In South American specimens the spikes are commonly two or more at the end of some culms, this form thus approaching the genus Chloris. This condition is rare in North American specimens, if those examined and collected are typical, but is sometimes found, however, in *B. procumbens*, as shown sparingly by *Griffiths* 9516, collected in the vicinity of Prescott, Arizona.

HERBARIUM SPECIMENS.

ARIZONA: *Leiberg* 5897, San Francisco Mountains.

COLORADO: *Chase* 2569, South Cheyenne Canyon; 6500, Pikes Peak Region; 5395, Harbert Ranch to Wet Canyon, Spanish Peaks. *Shear* 1262, Durango. *Hitchcock* 1771, Manitou.

MAINE: *Parlin* 1514, New Brunswick, introduced in sheep wool.

NEW MEXICO: *Wooton* 2925, Encinada. *Wooton & Standley* 3523, Lincoln County; 5049, San Miguel County; 212, Lincoln County. *Metcalfe* 1502, Kingston, 583, Soccoro County. *Baker* 90 and 163, Chama. *Jones* 4348, Grants.

UTAH: *Jones* 5995, Panguitch.

MEXICO: *Pringle* 1434, plains of Guerrero; 6450, Pedregal, Valley of Mexico; 13242, mesas near Zontecomate, Hidalgo; 11218, Federal District. *Palmer* 3, Chihuahua; 480, Guadalajara; 176, Alvarez; 332, near Saltillo; 397, 398, Saltillo; 712, Durango. *Schaffner* 1016, 156, San Luis Potosí.

2. Bouteloua simplex Lag.

Bouteloua simplex Lag. Var. Cienc. **2**[4]: 141. 1805. There is a specimen in the herbarium of the Madrid Botanical Garden named *Bouteloua simplex* by Lagasca.

Chondrosium humile Beauv. Ess. Agrost. 158. 1812. A name only listed in the index and based on *Actinochloa humilis*, a manuscript name of Willdenow published without description on page 41; H. B. K. Nov. Gen. & Sp. **1**: 175. *pl. 56*. 1816. The figures and description in the last work are sufficient to identify the species.

Actinochloa humilis Willd.; Roem. & Schult. Syst. Veg. **2**: 417. 1817. Based upon *Chondrosium humile* H. B. K.

Actinochloa simplex Roem. & Schult. Syst. Veg. **2**: 418. 1817. Based upon *Bouteloua simplex* Lag.

Atheropogon humilis Spreng. Syst. Veg. **1**: 293. 1825. Based upon *Chondrosium humile* H. B. K.

Eutriana humilis Trin. Gram. Unifl. 239. 1824. Based upon *Actinochloa humilis* Willd.

Chondrosium? simplex Kunth, Rév. Gram. **1**: 94. 1829. Based upon *Bouteloua simplex* Lag.

Bouteloua humilis Hieron. Bol. Acad. Cienc. (Córdoba) **4**: 495. 1882. Based upon *Chondrosium humile* Beauv.

Bouteloua brachyathera Philippi, Anal. Mus. Nac. Chile (Bot.) **8**: 85. 1891. The type, no. 287 of Philippi's herbarium, has been examined. [a]

Bouteloua rahmeri Philippi, Anal. Mus. Nac. Chile (Bot.) **8**: 85. 1891. Herb. Philippi, no. 268, Province of Terapaca, Chile, is the type. It has been through my hands and I find it a very good match for a specimen in the U. S. National Herbarium collected by Rusby (no. 34) near Yungos, Bolivia, in 1885.



FIG. 28.—*Bouteloua simplex.* Spikelet. Scale 7.5. From type specimen of *B. rahmeri.*

DESCRIPTION.

A prostrate or ascending, spreading, smooth annual, 20 to 25 cm. high; culms geniculate or ascending, seldom branched; sheaths smooth, deeply striate, rather loose, the ligule a conspicuous ring of short, white hairs; blades not abundant, short, narrow and inclined to be involute, about 3 cm. long; spikes terminal, normally 1 but sometimes 2 to 4, congested at the apex of the culm, varying from 2 to 4 cm. long, straw colored to purplish-tinged; spikelets commonly about 50, about 8 mm. long, including the awns, pectinate, consisting of a lower perfect floret and a rudiment; glumes sharply and hispidulously keeled, otherwise smooth, the lower about 3 mm., the upper 5 to 6 mm. long; lemma, including awns, about 6 mm. long, covered on the back with a long, scattered pubescence, 3-awned, the central awn 2 mm. longer than the lateral; palet smooth, obovate, awnless; rudiment consisting of 3 hispid awns, 5 or 6 mm. long, together with a few scales at base borne upon a hairy, tufted pedicel about 1 mm. long; caryopsis more or less triangular in vertical section, about 1.5 to 1.75 mm. long, slightly curved, the scutellum covering about two-thirds of the ventral surface. (FIGURES 28, 29.)



FIG. 29.—*Bouteloua simplex.* *a*, Spikelet; *b*, *c*, lemma and two views of palet of first floret; *d*, rudiment. *a*, Scale 7.5; *b–d*, scale 15. From type specimen of *B. brachyathera.*

This description is drawn from Miguel Bang's no. 81, in the John Donnell Smith Herbarium, from the vicinity of La Paz, Bolivia, altitude 10,000 feet. The original

[a] See discussion, p. 368.

description of the species is short: "culmo simplici, erectiusculo, monostachio: spica terminali, oblonga, glaberrima." This was written in 1805. In his later work,[a] Lagasca added to this the two facts that the habitat of the plant is Peru and that it is an annual. These facts in connection with the above description satisfy me that

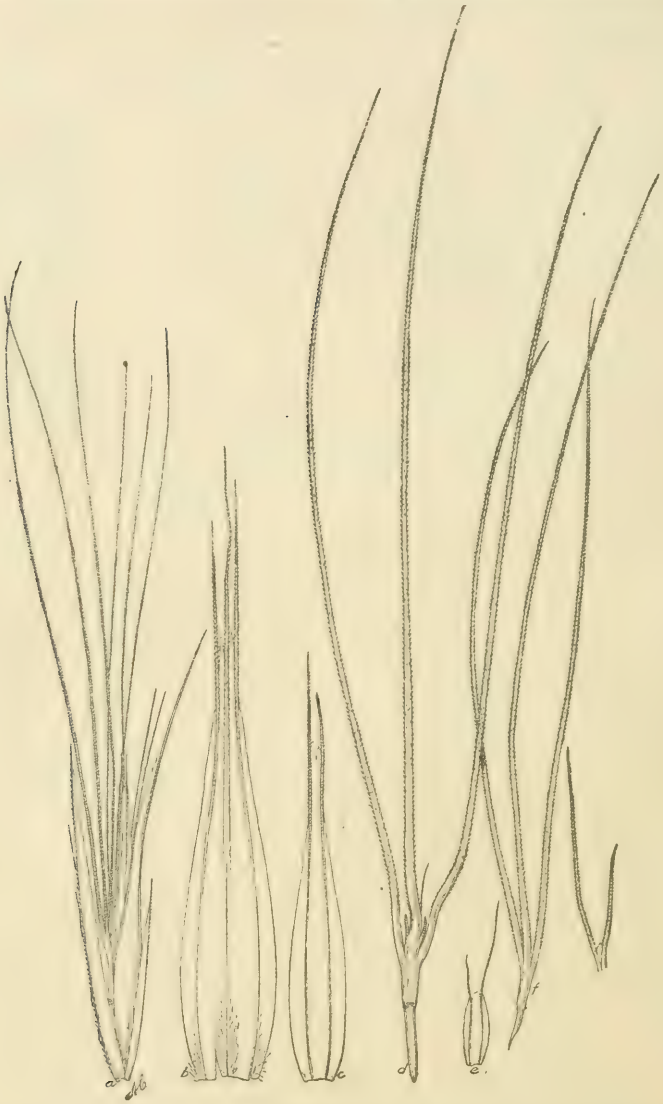


FIG. 30.—*Bouteloua stolonifera*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, *e*, rudimentary lemma and palet of second floret; *f*, *g*, rudimentary third and fourth florets. *a*, Scale 7.5; *b–g*, scale 10. From type specimen.

Lagasca had the South American form of what he described in the next paragraph as *B. prostrata*. Philippi gave two names to this species. His *B. brachyathera* is a single-spiked immature plant, but unmistakably this species. The type of his *B. rahmeri* is fragmentary and immature, having 2 or 3 spikes aggregated at the apex

[a] Gen. & Sp. Nov. 5. 1816.

of the culm. There are no differences between them in the spikelets and floral details. Miguel Bang's no. 81, of the John Donnell Smith collection, combines these two characters in one plant. Both of the Philippi specimens are from the Province of Tarapaca in the extreme northern part of Chile. South American material is very scanty in North American herbaria, and it may be that when more of it becomes available a still closer relation will be shown between this and *B. procumbens*.

HERBARIUM SPECIMENS.

South America: *Fries* 1058a, Bolivia; 813, Argentine. *Bang* 81, Bolivia. *Philippi*, 267 and 208, Chile. *Rusby* 34, Bolivia. *Stuckert*, Herb. Argent. 17700.

3. Bouteloua stolonifera Scribn.

Bouteloua stolonifera Scribn. Proc. Acad. Phila. **1891**: 302. 1891. The type is *Pringle* 3174, in the U. S. National Herbarium, from Honda Station, Zacatecas, Mexico, August 19, 1890.

DESCRIPTION.

A densely tufted, strongly stoloniferous, low, smooth perennial; sheaths short, indistinctly striate; blades flat, narrow, 3 to 5 cm. long, with involute edges, minutely scabrous under a lens, abundant and mostly radical; spikes solitary upon short, erect or ascending culms, 5 to 10 cm. high, recurved into a circle when mature, 2 to 2.5 cm. long; spikelets lax, 15 to 20, pectinate, about 15 mm. long including awns; glumes lanceolate, acuminate, the first 5 and the second 8 mm. long, smooth or minutely hispidulous on the keel; lemma smooth, 8 to 10 mm. long, including 3 long, unequal, hispid awns, the central 1 to 2 mm. longer than the lateral; palet about 5 mm. long, narrow, with involute margins, the 2 awns about 1 mm. long; rudiment consisting of 2 or 3 aborted florets in the shape of 5 to 8 or more long, hispid awns and 3 to 5 small scales upon a short stipe about 1 mm. in length; caryopsis not seen. (Figure 30.)

When not headed out this species resembles somewhat the female plants of *Bulbilis dactyloides*. It often grows thick enough in shallow depressions in the mesas to make a semblance of a turf. Extensive areas of it have not been seen.

HERBARIUM SPECIMENS.

Mexico: *Lloyd* 104, Cedros, Zacatecas. *Schaffner* 1879, San Luis Potosí. *Pringle* 3174, La Honda Station, Zacatecas.

4. Bouteloua scorpioides Lag.

Bouteloua scorpioides Lag. Gen. & Sp. Nov. 5. 1816. This species is identified on no other evidence than the brief description, "Culmo erecto filiformi monostachyo: spica lineari-oblonga spiraliter revoluta," and the additional information that the plant is from "N. Hisp." and perennial. Fournier referred this to *Chondrosium tenue* H. B. K., to which it is closely allied, the difference between them consisting chiefly in the perennial character of *Bouteloua scorpioides*. Fournier does not appear to have seen this species at all and consequently it was perfectly natural for him to refer this name to the annual *C. tenue*, which it so closely resembles.

Actinochloa? scorpioides Roem. & Schult. Syst. Veg. **2**: 420. 1817. Based upon *Bouteloua scorpioides* Lag.

Atheropogon scorpioides Spreng. Syst. Veg. **1**: 293. 1825. Based upon *Bouteloua scorpioides* Lag.

Chrondrosium? scorpioides Kunth, Rév. Gram. **1**: 94. 1829. Based upon *Bouteloua scorpioides* Lag.

DESCRIPTION.

A smooth, cespitose, half-prostrate or spreading perennial; culms ascending, seldom geniculate or branched, 20 to 30 cm. long; sheaths striate, smooth, close; blades narrow, involute, short, only 4 or 5 cm. long, with a narrow ligular fringe of white hairs; spike always solitary and terminal, 4 to 5 cm. long, revolute toward maturity; spikelets 50 to 70, pectinate, about 6 mm. long, consisting of a lower floret and an upper rudiment; glumes smooth, not sharply keeled, rounded to abruptly pointed, awnless, the lower 3.3 mm., the upper 5.3 mm. long; lemma densely hairy, 5.5 mm. long, with 3 equal awns and 4 lobes, the two central lobes being nearly as long as the awns, the lateral lobes short and attached nearly the entire length to the lateral awns; palet as long as the lemma, truncate, awnless; rudiment 5.5 mm. long, hairy-tufted, with 3 equal scabrous awns and 2 axillary scales representing the lobes of the lemma; caryopsis not seen. (FIGURES 31, 32.)



FIG. 31.—*Bouteloua scorpioides*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, *e*, rudimentary lemma and palet of second floret; *f*, rudiment of third floret. *a*, Scale 5; *b*–*f*, scale 7.5. From *Pringle* 8820.



FIG. 32.—*Bouteloua scorpioides*. *a*, Spike; *b*, spikelet; *c*, *d*, lemma and palet of first floret; *e*, rudiment. *a*, Scale 1; *b*, scale 5; *c*–*e*, scale 10. From *Griffiths* 8527.

This species is as uniformly 1-spiked as is *B. procumbens*. In other respects the herbarium material bears a close similarity to some single-spiked forms of *B. gracilis*. On the whole, however, the plants as well as the glumes are smoother and the spikes are longer, heavier, and more revolute. In the field the difference is still more striking. In this species the larger plants grow in more conspicuous bunches and are more spreading, and the general aspect, owing to this fact and the lack of pubescence, is entirely different. One-spiked forms of *B. gracilis* are not at all uncommon. Such forms might easily be confused with *B. scorpioides* by one who had never seen the latter in the field. The range of *B. scorpioides*, however, is apparently limited to the high plateau of central Mexico. One-spiked forms that have been examined from northern Mexico or the United States can not be referred to this species.

When Pringle's no. 8820, from Zontecomate Station, Hidalgo, Mexico, was first seen it was thought that it was a distinct species. Pittier's no. 422, from the State of

Puebla, and *Lloyd* 105, from Hacienda de la Cedros were placed with the Pringle collection. Later collections by myself, however, from the Valley of Mexico connect the small, narrow-leaved plants represented by *Pringle* 8820, with my large, comparatively wide-leaved plant from Encinillas. The species appears to vary from the large plant described above to a diminutive plant often not over 7 or 8 cm. high, having narrow, rather rigid, mostly radical leaves. The smaller forms resemble *B. procumbens* except that they are perennial, while the larger ones look more like single-spiked plants of *B. gracilis*.

The species has been collected at various places from northern Zacatecas to Orizaba and is especially abundant in the Valley of Mexico although not at all common in collections. Doubtless the common form of the Valley of Mexico may be found included with *B. procumbens* in some herbaria.

5. Bouteloua hirticulmis Scribn.

Bouteloua hirticulmis Scribn. U. S. Dept. Agr. Div. Agrost. Circ. **30** : 4. 1901. The type is T. S. Brandegee's no. 11, collected September 29, 1899, at Sierra de San Francisquito, Lower California.

DESCRIPTION.

A cespitose, erect, stout perennial, about 60 cm. high; culms simple, densely hirsute-pubescent below but naked above; sheaths short, striate, glabrous or with a few scattered hairs; ligule conspicuously ciliate-hairy; blades 10 to 20 cm. long, flat, minutely scabrous, tubercular-hairy near base; spikes 2 or 3, apparently normally 2, about 5 cm. long, upon short, curved, woolly peduncles, the rachis projecting 1 to 2 cm. beyond the distal spikelets; spikelets pectinate, numerous, 50 to 60, about 6 mm. long; glumes lanceolate, subulate-pointed, pubescent, the first 2.5 to 3 mm. long, the second 5 to 5.5 mm. long, the latter bearing upon the dorsal surface long papillose hairs, 1 to 3 mm. in length, much like those of *B. hirsuta;* lemma 3-lobed, with short awns from the 3 nerves, the central lobe 1 to 1.5 mm. longer than the lateral pair, hairy, especially on the nerves; palet 2-nerved, awnless, glabrous, narrowly ovate, 4 to 5 mm. long; rudiment consisting of 3 scabrous awns, 3 to 4 mm. long, expanded and scale-like below, the central slightly the longest, interspersed with 2 or 3 scales on a naked stipe 1 to 1.5 mm. long, bearing a few hairs at its apex; caryopsis not known. (FIGURE 33.)

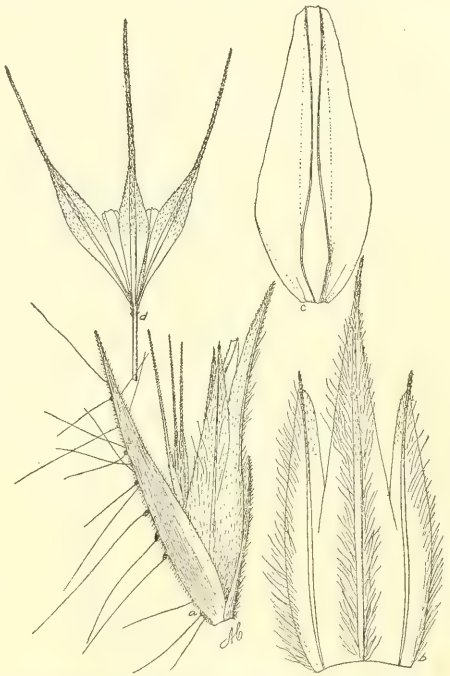


FIG. 33.—*Bouteloua hirticulmis*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, rudiment. *a*, Scale 7.5; *b–d*, scale 10. From type specimen.

This can be looked upon as a robust, hirsute, hairy-culmed form of *B. hirsuta*. Its tuberculate-hairy second glume and woolly culms are its distinguishing characteristics.

Palmer's no. 201, and Nelson's no. 1259 are typical. Nelson's no. 3121 (Roadside between Tuxtla and San Cristobal, Chiapas, Mexico, September, 1895, in U. S. National Herbarium) includes *B. hirsuta* and *B. hirticulmis* mounted on the same sheet, indicating that the collector considered them the same species and probably

found them growing intermixed. This still further goes to prove the close relationship of the two species and really throws a doubt upon the validity of *B. hirticulmis*. My own collection from western Jalisco illustrates the same close relationship. Indeed, frequent gradations may be found between this and *B. hirsuta* in the mountains northwest of Guadalajara. In the vicinity of Aguascalientes the species has less hairy culms, as shown by some of my own distributions. Further collections from the Pacific coast of Mexico, from Lower California to the Isthmus are necessary.

HERBARIUM SPECIMENS.

MEXICO, *Brandegee*, El Tase, Lower California. *Nelson* 3121 (in part), Chiapas; 1259, Valley of Oaxaca. *Palmer* 201, Rio Blanco, Jalisco.

6. Bouteloua hirsuta Lag.

Bouteloua hirsuta Lag. Var. Cienc. **2**[4]: 141. 1805. My interpretation of this is based upon the description and upon a specimen sent by Lagasca to Munich in 1820. A specimen in the herbarium of the Madrid Botanical Garden marked *B. hirsuta* in Lagasca's hand has both *B. hirsuta* and *B. gracilis* on the same sheet. This, however, is not the type, for that was burned in Lagasca's first herbarium. The spike of *B. hirsuta* from this specimen before me is very large and represents the largest of our southern forms of this species. The Munich and Madrid specimens appear to be from the same collection. See also U. S. Dept. Agr. Div. Bot. Bull. **12**[1]: *pl. 39. f. 1–3.* 1890; Britt. & Brown, Illust. Fl. **1**: 180. *f. 411.* 1896; U. S. Dept. Agr. Div. Agrost. **7**: 223. *f. 205.* 1897.

Bouteloua hirta "H. R. M."[a] Lag. Var. Cienc. **2**[4]: 141. 1805. A garden name mentioned as a synonym of *Bouteloua hirsuta; B. hirta* Scribn.[b] is based on *Chondrosium hirtum* H. B. K.

Chondrosium hirtum H. B. K. Nov. Gen. & Sp. **1**: 176. *pl. 59.* 1816. The plate identifies this without doubt, although the species normally bears 2 to 4 spikes, not one spike as figured and described.

Actinochloa hirsuta Roem. & Schult. Syst. Veg. **2**: 419. 1817. Based upon *Bouteloua hirsuta* Lag.

Eutriana hirta Trin. Gram. Unifl. 240. 1824. Based upon *Actinochloa hirsuta* Roem. & Schult.

Atheropogon hirtus Spreng. Syst. Veg. **1**: 293. 1825. Based upon *Chondrosium hirtum* H. B. K.

Chondrosium hirsutum Sweet, Hort. Brit. **1**: 455. 1826. A name only.

Atheropogon papillosus Engelm. Amer. Journ. Sci. **46**: 104. 1843. The description is sufficient to identify this. The type, in the Engelmann Herbarium, is Geyer's specimen collected near Beardstown, Illinois, in 1842. A specimen so named corresponding to this description in the Gray Herbarium further identifies it. This is mounted on the same sheet as Mead's specimen from Mason County, Illinois, collected August 25, 1845.

Chondrosium aschenbornianum Nees, Linnaea **19**: 692. 1847. The type is Aschenborn Exsic. no. 331. The specimen of this in Willdenow's herbarium is *Bouteloua hirsuta*. Fournier has listed many numbers from Mexican collectors under this name but all others examined from whatever source are *B. gracilis*. As an illustration of the mix up, my notes on Bourgeau's no. 448 are interesting. In the National Herbarium *B. gracilis* and *B. hirsuta* are found under this number on the same sheet. In the Gray Herbarium, and the herbaria at Paris and at the St. Petersburg Botanical Garden, this number is *B. gracilis*, while a duplicate of the type in the Willdenow Herbarium is *B. hirsuta*.

[a] I. e., Hortus Regius Matritensis. [b] Contr. Nat. Herb. **2**: 531. 1894.

Chondrosium foenum Torr. in Emory, Mil. Reconn. 154. *pl. 12*. 1848. The plate is sufficient to identify this.

Chondrosium papillosum Torr. in Marcy, Expl. Red. Riv. 300. 1852. Based upon *Atheropogon papillosus* Engelm.

Bouteloua foena Torr. Cat. Pl. Surv. W. 100th Merid. 18. 1874. Based upon *Chondrosium foenum* Torr.

Chondrosium drummondii Fourn. Mex. Pl. **2**: 137. 1881. The type number (*Drummond* 323) in the herbarium of the Muséum at Paris and in the herbarium of the St. Petersburg Botanical Garden belong to this species, but the prolongation of the rachis is rather short in the fragments before me from both the above depositories. A photograph of the type taken for me by A. S. Hitchcock in 1907 represents the typical form of the species.

Bouteloua aschenborniana Griseb.; Fourn. Mex. Pl. **2**: 137. 1881. A manuscript name mentioned as a synonym of *Chondrosium aschenbornianum* Nees.

Bouteloua palmeri Vasey, Bull. Torrey Club **14**: 9. 1887. A name only. Vasey observes that this species, which was distributed to some extent under this name, is a variety of *B. hirsuta*.

Bouteloua hirsuta minor Vasey, U. S. Dept. Agr. Div. Bot. Bull. **12**[1]: *pl. 39. f. 2.* 1890. See *B. hirsuta major*. The type of this variety appears to be a specimen collected in Texas, 1883, by S. B. Buckley.

Bouteloua hirsuta major Vasey, U. S. Dept. Agr. Div. Bot. Bull. **12**[1]: *pl. 39. f. 3.* 1891. The specimen in the National Herbarium locates Vasey's work without doubt, although the label is not in Vasey's writing.

Bouteloua hirsuta palmeri Vasey; Beal, Grasses N. Amer. **2**: 417. 1896. Vasey says[a] that this has been distributed as *B. palmeri*, but he refers it to *B. hirsuta*. The specimen in the National Herbarium plainly marked by Vasey "Cultivated from seed collected by Palmer in Mexico, 1886," fixes the type without any question. Watson[b] also uses this name.

Bouteloua bolanderi Vasey; Beal, Grasses N. Amer. **2**: 417. 1896. Beal mentions this as a synonym under *B. hirsuta* variety *palmeri*. It is said to have been cultivated from seed collected by Palmer in Mexico in 1886. I have not been able to find in the National Herbarium any specimen marked *B. bolanderi*.

Bouteloua hirta Scribn. Contr. Nat. Herb. **2**: 531. 1894. Based on *Chondrosium hirtum* H. B. K.

Bouteloua hirta major Vasey, Contr. Nat. Herb. **2**: 531. 1894.

Bouteloua hirta minor Vasey, Contr. Nat. Herb. **2**: 531. 1894.

DESCRIPTION

A cespitose, rigid, erect perennial of very variable habit, size, and general appearance, in the northern portion of the Great Plains forming a sod, but in the Southwest and in Mexico growing in isolated clumps, rather rigid and stout, with unbranched culms, smooth, striate, close sheaths, small, ciliate ligule, and flat, somewhat hispid, narrow blades, more numerous below than above; panicle racemose, 3 to 5 cm. long, bearing 1 to 4 spikes, normally 2 in the north but more commonly 3 or 4 in the south, 2.5 to 3.5 cm. long, with a projection of the rachis 5 to 8 mm. beyond the last spikelets; spikelets numerous, 35 to 45, pectinate, consisting of a lower, fertile floret and an upper rudiment, glumes unequal, the first minutely hispid, about 3 mm. long, acuminate, the second acuminate, short-awned, about 6 mm. long, minutely hispid and conspicuously tuberculate-hairy; lemma 3-toothed, the central tooth terminating in a short, hispid awn slightly longer than the lateral teeth, these simply acuminate-pointed, conspicuously pubescent; palet oval, broadly pointed; rudiment consisting of 3 hispid, equal awns, about 6 mm. long, and one or two small scales upon a stipe, 1 to 2 mm.

[a] Bull. Torrey Club **14**: 9. 1887. [b] Proc. Amer. Acad. **22**: 461. 1887.

long, the latter slightly pubescent above; caryopsis about 1.5 to 2 mm. long, 0.5 mm. wide, oval, more or less pointed at both ends, the scutellum covering nearly the entire ventral surface and the embryo extending nearly to the apex. (FIGURE 34.)

The distribution of this species is very wide, from British Columbia southward through the continental highland and again at points along the Gulf coast in Florida. As in the case of *B. gracilis* the northern and southern forms differ widely in both habit and general aspect, the northern being shorter as a rule and showing a tendency to form a sod, while the southern is in the strictest sense a bunch grass. It reaches its best development upon stable, sandy-loam soils and extends in New Mexico and Arizona into the upper foothills. The most abundant development that has been met

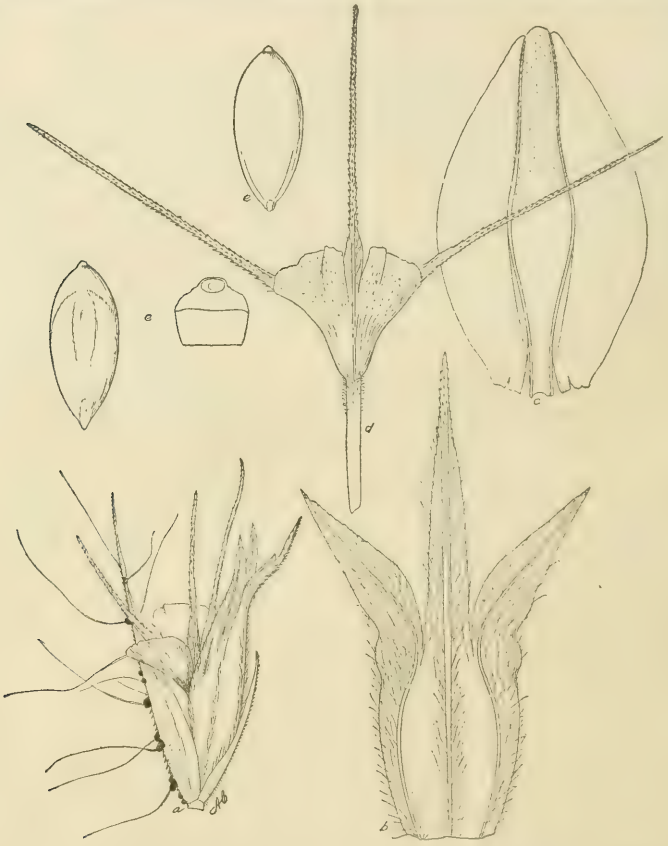


FIG. 34.—*Bouteloua hirsuta*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, rudiment; *e*, two views and cross section of caryopsis. *a*, Scale 7.5; *b–e*, scale 12.5. From *Griffiths* 6125.

with is in the sandy lands of the Texas-New Mexico line east of Roswell and in foothills from Arizona south. In the former situation this and two or three species of Andropogon constitute about the only forage. It also grows almost to the exclusion of all else in localities upon the plateau of central Mexico.

The species is well understood and seldom incorrectly named in collections. Its distinguishing characteristics are the prolongation of the rachis beyond the spikelets, the tuberculate, hairy glumes, and the more or less papillose-hairy leaf margins. *Heller* 1878, *Lemmon* 3175 and 4673, *Pringle* 409, and *Palmer* [illegible]57 are typical. Clements's no. 1 (Manitou, Colorado) and Rydberg's no. 1552 are [illegible] spiked forms which are common enough, but not so commonly collected.

HERBARIUM SPECIMENS.

ARIZONA: *Jones* 540, Bowie. *Lemmon* 4639, 4637, and 4640, S. E. Arizona; 3175. Sulphur Spring Valley. *MacDougal* 616, Beaver Creek. *Toumey* 26, Prescott, *Griffiths* 1865, Dragoon Mountains; 1948, Pearce; 1809, Rincon Mountains; 3375 and 3371, Santa Rita Mountains. *Griffiths & Thornber* 26 and 222, Santa Rita Mountains. *Hitchcock* 3700, Patagonia; 3732, Benson.

COLORADO: *Williams* 2117, Colorado Springs. *Rydberg* 2360, Meadow Park. *Hitchcock* 2270, Ouray.

FLORIDA: *Simpson* (December, 1891). *Garber* (November, 1878). *Combs & Baker* 1105, Orange County. *Baker* 33, Orange County.

ILLINOIS: *Patterson* 590, Oquawka. *Wilcox* 58, on Mississippi River; 41, Aurora; 63, Manito. *Gleason* 1003, Havana.

IOWA: *Ball* 116, Ames.

KANSAS: *Smyth* 78, Greensburg. *Shear* 147 and 702, Osborne. *Norton* 908, Riley County. *Thompson* 125, Syracuse.

MISSOURI: *Bush* 389a, Atchison County.

NEBRASKA: *Rydberg* 1552, near Mullen. *Morris* 434a. *Williams* 3008, Weeping Water. *Clements* 2738, Pishelville. *Elmer* 133, Crete.

NEW MEXICO: *Wooton* 419 and 1098, Organ Mountains. *Vasey* 101, Organ Mountains. *Metcalfe* 754, Bear Mountains. *Plank* 19, Socorro. *Greene* 403, Silver City. *Hitchcock* 3790, Organ Mountains. *Standley* 4977, San Miguel County. *Fendler* 951 of 1847.

SOUTH DAKOTA: *Thornber* 242, Sioux Falls. *Rydberg* 1135, Hot Springs.

TEXAS: *Riggs* 66, Marshall. *Lindheimer* 731 (Fasc. IV). *Jermy* 781, Gillespie County. *Nealley* 353 and 93, Santa Ana. *Letterman*, San Antonio (1882). *Buckley* (1881). *Heller* 1878, Kerrville. *Reverchon* 4216 and 1153, Dallas; 4, Comanche Peak; 4089, Wood County. *Bailey* 740, Guadalupe Mountains; 393, Chisas Mountains. *Tracy* 8205, Dallas; 8221, Colorado; 8213, Weatherford; 8214, Big Springs; 8205, Fort Worth. *Ball* 994 and 893, Chillicothe.

MEXICO: *Conzatti* 2013, State of Oaxaca. *Schaffner* 1018, San Luis Potosí; 158, Valley of Mexico. *Pringle* 409, Chihuahua; 11215, Tula. *Wilkinson* 347, Santa Eulalia Mountains. *Brandegee* 25, Cape Region, Lower California; 11, Sierra de Laguna, Lower California. *Palmer* 405, Saltillo; 807, Durango. *Parry & Palmer* 943, San Luis Potosí. *Nelson* 6246, Pacheco, Chihuahua. *Rose* 1904 and 3293, Territory of Tepic; 2588, State of Jalisco.

7. Bouteloua gracilis (H. B. K.) Lag.

Actinochloa ciliata Willd.; Beauv. Ess. Agrost. 41. 1812. (See *Chondrosium ciliatum.*)

Chondrosium ciliatum Willd.; Beauv. Ess. Agrost. 158. 1812. Beauvois lists this name in the index, basing it upon the above manuscript name of Willdenow. In Beauvois's personal copy of his Essai,[a] he has written in the index in his own hand that this is *C. gracile* H. B. K.

Chondrosium gracile H. B. K. Nov. Gen. & Sp. **1**: 176. *pl. 58.* 1816. The cited plate and description, together with a specimen in Willdenow's herbarium, "ex herb. Humboldt ex herb. Kunth" leave no doubt in my mind that this is what in this country we have long called *B. oligostachya.* It is true that Kunth figures a single-spiked plant, which is the uncommon form. It is rather curious that Humboldt and Bonpland did not collect the more common form, but not nearly so curious as it would have been if they had not collected this widely distributed species at all. Kunth also figures a single-spiked form of *B. hirsuta,* though this is the less common form of that species.

[a] This copy is now in the library of the U. S. Department of Agriculture.

Actinochloa gracilis Willd.; Roem. & Schult. Syst. Veg. **2**: 418. 1817. Based upon *Chondrosium gracile* H. B. K.

Atheropogon oligostachyum Nutt. Gen. Pl. **1**: 78. 1818.

Eutriana gracilis Trin. Gram. Unifl. 240. 1824. Based upon *Actinochloa gracilis* Willd.

Atheropogon gracilis Spreng. Syst. Veg. **1**: 293. 1825. Based upon *Chondrosium gracile* H. B. K.

Eutriana? oligostachya Kunth, Rév. Gram. **1**: 96. 1829. Based upon *Atheropogon oligostachyus* Nutt.

Bouteloua gracilis Lag.; Steud. Nom. Bot. ed. 2. **1**: 219. 1840. Based upon *Chondrosium gracile* H. B. K.

Chondrosium oligostachyum Torr. in Marcy, Expl. Red Riv. 300. 1852. Based upon *Atheropogon oligostachyum* Nutt.

Bouteloua oligostachya Torr.; A. Gray, Man. ed. 2. 553. 1856; see also U. S. Dept. Agr. Div. Bot. Bull. **12**[1]: *pl. 41.* 1890; Britt. & Brown, Illustr. Fl. **1**: 180. *f. 412.* 1896; U. S. Dept. Agr. Div. Agrost. Bull. **7**: 222. *f. 204.* 1897 and op. cit. **20**: 106 *f. 80.* 1900.

Bouteloua oligostachya intermedia Vasey, Grasses U. S. 33. 1883. A name only. No specimen so marked can be found in the National Herbarium.

Bouteloua oligostachya? major Vasey, Descr. Cat. Grasses U. S. 62. 1885; Dewey, Contr. Nat. Herb. **2**: 531. 1894; Beal, Grasses N. Amer. **2**: 418. 1896.

Bouteloua major Vasey, Bull. Torrey Club **14**: 9. 1887. Vasey publishes a name only and refers to specimens previously distributed under it. He also states that this is a variety of *B. oligostachya*. The type is a specimen cultivated from seed collected by Palmer in Chihuahua, Mexico, in 1886.

Bouteloua stricta Vasey, Bull. Torrey Club **15**: 49. 1888. A very brief description is given; a fuller description is furnished later.[a] The type is C. G. Nealley, without number, western Texas, 1887. The species commonly assumes in the southwest the form represented by Vasey's type.

Bouteloua oligostachya pallida Scribn.; Beal, Grasses N. Amer. **2**: 418. 1896. *Pringle* 407 is the duplicate type in the National Herbarium. There appears to be no good reason for recognizing such a variety. Pallid and dark-colored forms may be found in nearly all species of the genus.

DESCRIPTION.

A stout, erect, smooth, cespitose perennial, forming a rough sod in the north, but usually in isolated tufts in the south and much larger and ranker in growth; culms branched only at the very base if at all, sheaths loose, striate, smooth; ligule reduced to a line with at most only a few scattered hairs; blades linear, rather abundant, about 5 to 10 cm. long, 1 to 2 mm. wide, flat, minutely scabrous-margined; spikes normally 2, often 1 or 3 or 4, seldom 5 or 6, very variable in length, commonly above 3 cm.,[b] more or less recurved in age with no projecting sterile rachis; spikelets pectinate, on short, minutely pubescent pedicels, numerous, often as many as 80, consisting of a fertile flower and a rudiment; glumes lanceolate, short-awned, keeled, minutely scabrous, the lower 3 to 3.5 mm. long, the upper 5 to 6 mm. long; lemma about 6 mm. long, pubescent, 3-awned, the central awn slightly longer, all hirsute; palet about 5 mm. long, shortly 2-awned from the nerves, the latter slightly hirsute above; rudiment consisting of 3 scabrous, nearly equal awns with 2 or 3 scales at their bases all supported on a short stipe, 1 to 1.3 mm. long, hairy-tufted at base and apex; caryopsis 2.5 to 3 mm. long, 0.5 mm. wide, concave on the dorsal and sharply convex

[a] U. S. Dept. Agr. Div. Bot. Bull. **12**[1]: *pl. 45.* 1890.

[b] One specimen without data from Thurber's herbarium in Herb. Mo. Bot. Gard. has spikes 9 cm. long.



A. LARGE NATIVE CROP OF BOUTELOUA GRACILIS (H. B. K.) LAG.



B. BOUTELOUA GRACILIS ON THE MEXICAN BORDER OF ARIZONA.

on the ventral surface, the scutellum covering over three-fourths of the ventral surface. (Plate 72, A, B. Figure 35.)

This is without doubt the most important economic species of the genus, extending from Manitoba to South America. It is doubtfully reported from Tampa, Florida. As would be expected from a plant of such wide range, it is extremely variable. The above description is drawn in the main from my no. 6108 from the Sonoyta Valley of Arizona, which is very different from the plains region form. The latter produces a rough, rather bunchy sod and sends up but few culms, the abundant basal leaves forming a curly covering close to the ground, the species on this account often being confused in the popular mind with the buffalo grass (*Bulbilis dactyloides*). But in the southern desert region where, along the Mexican border, it grows in abundance at an altitude of about 5,000 feet it is usually in isolated large bunches. In favorable situations in swales such as are found on the eastern slope of the Santa Rita Mountains of Arizona it assumes more nearly the appearance of the northern form so far as habit is concerned (Pl. 72, B). In the South the plants usually grow much larger. It is



Fig. 35.—*Bouteloua gracilis*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, *e*, rudiments of second and third florets. *a*, Scale 7.5; *b–e*, scale 15. From type specimen of *B. stricta*.

not at all uncommon to find plants there 60 or 70 cm. high, while upon the prairies of the Dakotas the species seldom grows over half as high.

The difference in habit has been assumed by some to indicate a different species, but after studying the species from North Dakota to Oaxaca and cultivating it several times I am not able to take this view. It must be considered that the prairie form of the Dakotas and Montana occurs not only upon the cold, high prairies of the north, but upon the high tableland of northeastern New Mexico (Pl. 72, A), upon the San Francisco highland of northern Arizona, upon the Santa Rita highland of southern Arizona, and in many isolated localities in highland Mexico. This low turf-forming form passes by imperceptible gradations into the tall, robust, strictly bunchy form represented best by the type of *B. stricta*.

Explanation of Plate 72.—A. A growth of *Bouteloua gracilis* under plains conditions in northeastern New Mexico. For several years this locality has been grazed during the winter months only. B. A turf of *Bouteloua gracilis* at an altitude of 5,000 to 6,000 feet. Compare with figure A. This species does not form a turf thus far south, except at a considerable altitude and under favorable soil and moisture conditions.

Again, when the northern turf-forming and the southern bunched form are grown together their habits are more alike. Both will form a turf under proper moisture conditions, and both when cultivated become tall and rank, similar to *B. stricta* (Pl. 69, B).

In the publications of the United States Department of Agriculture this species is usually referred to as "blue grama." The Spaniards of our southwest as well as of Mexico refer to it simply as "grama," which they do not distinguish from similar species.

One of the most valuable characteristics of this species, as well as of some others of the genus, is the short period of development. It is a 60 to 80 day grass. Upon the Dakota prairies it produces fresh feed in late May and matures during the drought of August. In southern Arizona and the highlands of Mexico it starts to grow about the middle of July and matures with the close of the rainy and cooler season of late September and early October. It grows in regions where it is cured by drought and not by frosts, the effect being a dead herbage which retains much of its nutriment, making good dry grazing during the winter season, the value of the grass being proportionate to the dryness of the season. A rain after it has cured much reduces its value.

Shear's no. 813, *Knowlton* 140 and 141, *Rydberg* 3429, *Williams* 2143, *Nelson* 8307, *Merrill & Wilcox* 447, *Ward* 47, and *Griffiths* 40 are typical of the prairie and northern Rocky Mountain region. In unsodded regions from Colorado southward except at higher elevations, it assumes more of the characters exhibited by specimens collected by Wilcox at Fort Huachuca, in 1884, *Mearns* 2301, *Metcalfe* 698, *Pringle* 407, and *Townsend & Baker* 257. *Parish Brothers* 1528, Herb. Colo. State Agr. College 3534 (distributed by N. Y. Bot. Gard.), *Skehan* 64, and *Nealley* from Texas, in 1887, are mostly 1-spiked forms, and such forms occur throughout the range of the species. They are to be looked upon as dwarfs. They appear to be very common in the lower Sierras in California, at least they have been collected there a number of times.

There is a very peculiar form of the species in the extreme western portion of northern Texas. It differs from the common form mainly in its hairiness, but it occurs in perfectly circumscribed patches among the other form and can be readily distinguished at some distance. It has been seen twice north of Texline, but has never been collected and has not been detected in any of the collections examined. So far as hairiness is concerned, however, it is almost perfectly matched by a collection by Lindheimer (Herb. Texicana Exsic. no. 731) in the herbarium of the Missouri Botanical Garden. This, however, is the large, robust, southern form which differs in general appearance from the inhabitant of the plains.

HERBARIUM SPECIMENS.

ARIZONA: *Blumer* 1704, Chiricahua. *Hitchcock* 3676, Patagonia. *Chase* 5834, Flagstaff. *Hough* 12, Moki Reservation and Little Colorado River. *Leiberg* 5927, San Francisco Forest Reserve. *Griffiths* 3369 and 3370, Santa Rita Forest Reserve; 1863, Dragoon Mountains; 1552, Tucson; 1980, Pearce; 1905, Wilcox; 6108, Fort Crittenden. *MacDougal* 299, Flagstaff. *Mearns* 923, Bisbee; 1127, San Pedro River; 2301, White Water; 2090, San Luis Mountains. *Jones* 4240, Bowie. *Lemmon* 4641, 4642; northern Arizona, 427, 428. *Toumey*, Chiricahua Mountains; 20, Santa Catalina Mountains. *Wilcox*, Fort Huachuca. *Griffiths & Thornber* 225, Santa Rita Mountains; 264, Empire Ranch.

CALIFORNIA: *Hall* 7589, Santa Ana Canyon. *Wilder* 744, San Bernardino Mountains. *Grinwell* 354, San Bernardino Mountains. *Abrams* 2100, San Bernardino County. *Parish Brothers* 1528, Bear Valley, San Bernardino Mountains. *Lemmon* 5445.

COLORADO: *Chase* 5303, Manitou; 5290, Pikes Peak Region; 5393 and 5403, Harbert Ranch, Las Animas County; 5346, near Starkville. *Tidestrom* 65a, Hugo. *Shear*

858, Alamosa; 813, Huerfano County; 7491, Colorado Springs; 978, Canyon City; 776, Walsenburg; 642, Georgetown. *Williams* 2143, Floressant; 2127, Colorado Springs. *Wolfe* 1112, 1113, 1114, Twin Lakes. *Baker, Earle & Tracy* 971, Durango. *Shear & Bessey* 1419, Yampa. *Hitchcock* 1728, Pikes Peak; 1701, Garden of Gods. *Snow* 31a, Estes Park. *Vasey*, Fort Garland, 1884. *Griffiths* 3303, Rocky Ford. *Holm* 584, Gunnison.

KANSAS: *Hitchcock* 3834, Manhattan. *Shear* 705 and 153, Osborne. *Thompson* 53, Ulysses; 126, Linville; 31b, Ness County. *Norton* 909, Riley County.

MINNESOTA: *Moyer* 23, Montevideo.

MISSOURI: *Bush* 589, 489, Sheffield; 390a, Atchison.

MONTANA: *Williams & Griffiths* 219, Billings. *Griffiths & Lange* 310, Chateau; 297, Du Puyer; 231, Mission Holy Family. *Rydberg* 3429, Judith River; 2179 and 2290, Manhattan. *Scribner* 377, Teton River; 2104, Melrose. *Williams* 305, Great Falls. *Shear* 409, Manhattan; 351, Melrose.

NEBRASKA: *Rydberg* 1574, Plummer Ford; 2012, Central City; 1803, Hooker County. *Clements* 2737, Pishelville.

NEW MEXICO: *Wooton & Standley* 3524, White Mountains. *Hitchcock* 3781, Organ Mountains. *Metcalfe* 1308, Kingston; 698, Bear Mountains. *Standley* 4404, Holy Ghost Creek; 4911, San Miguel County; 3524, White Mountains. *Fisher* 26, Torrence. *Wooton* 206, Lincoln County; 2962, Kennedy; 1097, Organ Mountains. *Mearns* 2331, Dog Mountains; 2510, Animas Valley. *Tracy* 8199, Carlsbad. *Wright* 2023. *Fendler* 947, 948. *Skehan* 64, Gray. *A. A. & E. G. Heller* 3779, Santa Fe. *Earle* 64, Gray.

NORTH DAKOTA: *Brannon* 104, Minot.

OKLAHOMA: *Ward* 47, Carville. *Bush* 787, Sapulpa.

SOUTH DAKOTA: *Wilcox* 2, Brookings. *Griffiths* 137 and 800, Aberdeen; 26, Pierre; 40 and 767, Pierre to Huron; 363, Bellfourche; 319, Bixby; 210, Redfield; 746a, near Willow Creek. *Wallace* 20, White River. *Rydberg* 1136, Hot Springs.

TEXAS: *Ball* 996 and 894, Chillicothe. *Jermy*, Bexar County. *Hopkins*, Jeff Davis County. *Nealley* of 1887 (dwarf).

UTAH: *Tidestrom* 2854, Beaver. *Garret* 2541, Fish Creek Canyon. *Ward* 419. *Jones* 5647, Thurber; 5972a, Marysvale; 6002, Panguitch Lake; 5204, Cedar City. *Ward* 419 and 743, Rabbit Valley.

WYOMING: *Chase* 5237, Sundance; 5259 and 5260, Fort McKinney. *Rose* 472, Clark. *Knowlton* 1404 and 141, Lance Creek. *Merrill & Wilcox* 447, Laramie. *A. Nelson* 8349, Cassa; 8447, New Castle; 8295, Torrington; 8307, Fort Laramie; 2677, Continental Valley; 7441, Albany County; 3619, 3658, and 3909, Laramie County. *E. Nelson* 438, Laramie River; 438, Albany County. *Griffiths* 972, Beulah; 507, Bear Lodge Mountains; 297, White Horse Camp; 698, New Castle; 526, Devils Tower; 501, Sundance. *Merrill* 2 and 3, Laramie. *Williams* 2588, Sundance.

CANADA: *Macoun* 2155, Northwest Territory; 13057, Assiniboia; 13035, Manitoba; 30043, Winnipeg; 30045, Assiniboia. *Hitchcock* 4979, Calgary; 4952, Alberta. *Macoun & Herriot* 72934, Saskatchewan; 72935, Alberta.

MEXICO: *Pringle* 407, Chihuahua. *Schaffner* 132, San Luis Potosí; 1015, San Rafael. *Wilkinson* 63, Santa Eulalia Plains, Chihuahua. *Schumann* 1723, Parral. *Palmer* 24, Chihuahua; 545, Durango; 403 and 399, Saltillo. *Bourgeau* 448, Santa Fe. *Townsend & Baker* 257, Colonia Garcia. *Mearns* 1658, San José Mountains. *Parry & Palmer* 944, San Luis Potosí. *Lloyd* 242, Pico de Tierra, Zacatecas. *Nelson* 6330, Casas Grandes, Chihuahua. *Rose & Painter* 6710, Hidalgo.

8. Bouteloua breviseta Vasey.

Bouteloua breviseta Vasey, Contr. Nat. Herb. **1**: 58. 1890. The type is C. G. Nealley's no. 669, from Screw Bean, Presidio County, Texas, September, 1889. See also U. S. Dept. Agr. Div. Agrost. Bull. **7**: 219. *f. 201.* 1897.

DESCRIPTION.

A stout, rigid, erect perennial, 25 to 40 cm. high, with branching, perennial culms, the internodes, when protected, covered with a thick, scaly bloom, cespitose, spreading by short, stout, scaly rootstocks; sheaths rather close, striate, covering nearly the entire internode; ligule sparingly ciliate-hairy; blades small, 3 to 6 cm. long, convolute, narrow, rigid, acuminate-pointed, bearing a few scattered hairs on the upper surface; spikes normally 2, often 1 and less frequently 3, linear-oblong, 2 to 2.5 cm. long, straight or slightly recurved; spikelets numerous, 30 to 45, pectinately arranged, about 3 mm. long, consisting of a lower perfect floret and a rudiment, with often a very small second rudiment; first glume 2 to 2.5 mm., the second 3 to 3.5 mm. long, nearly smooth; lemma about 5 mm. long, having 4 teeth and 3 awns of nearly equal length, pubescent; palet smooth, awnless, rudiment about 4.5 mm. long, of 3 hispid awns of about equal length and a rudimentary scale, all arising from a tuft of long, white hairs at apex of a stipe. (FIGURE 36.)

This is a very interesting species, apparently confined to the calcareous soils of the Rio Grande Valley and its tributaries. It is one of the important grasses upon the

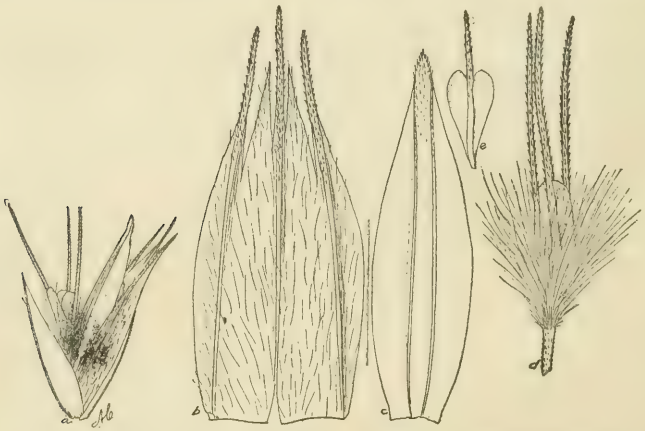


FIG. 36.—*Bouteloua breviseta*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *c*, *d*, rudiments of second and third florets. *a*, Scale 7.5; *b–d*, scale 15. From *Nealley* 669.

white (gypsum) sands of southeastern New Mexico, where it often creeps into rather unstable earths. Good stands of the grass occur in the Pecos Valley upon soils containing 73.2 per cent calcium sulphate and 3.2 per cent calcium carbonate, according to the analysis of a sample collected in 1903 and submitted early in 1904 to the Bureau of Soils of the Department of Agriculture. In the Roswell district of New Mexico *B. breviseta* is very evidently confined to the gypsum deposits and is popularly known as "gyp" grass. It is a tough, wiry species, but is nevertheless utilized to a very large extent as a pasture grass. The amount of trampling which it endures is remarkable. The deposits of gypsum occur here between the water in and along the Pecos and the better grazing grounds upon the mesas beyond the bluffs. Because of this the trampling across this deposit is very heavy. The tenacious character of the grass is strikingly exhibited in the regions of heaviest traveling. Having perennial culms it is of particular service during a prolonged drought.

There are a number of specimens in the National Herbarium which correspond exactly with the type. *Havard*, western Texas, 1881; *Nealley* 785; *Wooton* 64 Otero County, New Mexico; and *Bailey* 340, Boquillas, Texas, are representative.

9. Bouteloua ramosa Scribn.

Bouteloua ramosa Scribn.; Vasey. U. S. Dept. Agr. Div. Bot. Bull. **12**[1]: *pl. 44.* 1890. No specimen is cited in the original description. Beal[a] cites Nealley's specimen from southwestern Texas. It is impossible now to locate the plant from which Vasey drew up the description. However, it is certain that it was a Nealley specimen, as Beal suggests. At any rate Vasey's figures leave no doubt as to the species, and there are several Nealley specimens of this species in the National Herbarium. See also U. S. Dept. Agr. Div. Agrost. Bull. **7**: 218. *f. 200.* 1897.

Bouteloua oligostachya ramosa Scribn.; Beal, Grasses N. Amer. **2**: 418. 1896. Reference is made by Beal to the U. S. Dept. Agr. Div. Bot. Bull. **12**[1]: *pl. 44.* 1890, for this and *B. ramosa* (which see), but he cites *Pringle* 414 from Mexico under this variety. The same thing is referred to in each case and the inclusion of it in two places is evidently due to an oversight in editing. *Palmer* 1358 and *Pringle* 414 are also typical of the species.

The floral details of this species differ in no way from those of *B. breviseta*, but the habit is quite different. The culms, while of the same general half-perennial character and freely branched, are more spreading and invariably geniculate. The species grows on rough, stony, limy soils, from the lower Rio Grande region southward.

It is more than probable that further study will prove this to be really a form of *B. breviseta*, but there is not at the present time sufficient evidence available in collections to warrant making such a disposition formally.

HERBARIUM SPECIMENS.

Texas: *Nealley* 108, Presidio County; Chende Mountains; Presidio County; 108½, Sanderson, Pecos County. *Bailey* 340, Boquillas.

Mexico: *Pringle* 414, Chihuahua. *Wilkinson* 346, Santa Eulalia Mountains. *Palmer* 1358, Monclora; 404, Saltillo. *Rose & Painter* 7729, Aguascalientes.

10. Bouteloua parryi (Fourn.).

Chondrosium parryi Fourn. Mex. Pl. **2**: 150. 1881. Fournier cites as the type of this species Parry and Palmer 923½, but this is evidently a misprint for 943½.[b]

Bouteloua polystachya vestita Wats. Proc. Amer. Acad. **18**: 177. 1883. Palmer 1357 Sierra Madre, Nuevo León, Mexico, August, 1880, in the Gray, Herbarium,is the type. Parry and Palmer's no. 943½ cited by Watson is also in the National Herbarium.

Bouteloua vestita Scribn. in Dewey, Contr. Nat. Herb. **2**: 531. 1894. Presumably based on *B. polystachya vestita* Wats. since Watson is cited in parentheses, but no synonyms are given. See also U. S. Dept. Agr. Div. Agrost. Bull. **7**: 220. *f. 202.* 1897.

DESCRIPTION.

A woolly-pubescent, short-lived perennial, erect or reclining, the geniculate culms being simple or branched, cespitose or, when growing thickly, the individual culms scattering; sheaths loose, striate, pubescent, the ligule reduced to a ciliate-hairy line, with hairs a little more prominent than those on the edges of the sheaths; blades pubescent with long, scattered, minutely papillose hairs, 2 to 3 mm. long; spikes 4 to 8, usually 5 or 6, bilateral, but the black peduncle so curved as usually to make them appear unilateral, 2.5 to 3.5 cm. long; spikelets 40 to 65, pectinate, upon a slender, papillose-hairy rachis, consisting of a lower fertile floret and one or more upper rudiments; glumes keeled, the first smooth or sparingly pubescent at base, about 2 mm. long, with a short awn, the second woolly, with minutely papillose hairs, 3 or 4 mm. long, with minutely scabrous awn about 0.7 mm. long; lemma 3 to 4 mm. long,

[a] Grasses N. Amer. **2**: 416. 1896. [b] See Proc. Amer. Acad. **18**: 177. 1883.

densely pubescent, 4-toothed, with 3 scabrous equal awns, about 2 mm. long; palet 4-toothed, 2-awned, pubescent on the edges only, about 2.5 mm. long; rudiment consisting of 3 scabrous, equal awns, about 4 mm. long, together with two or three small scales upon a stipe about 1 mm. long, bearing a tuft of long hairs at each end; caryopsis obovate, pointed at both ends, about 1.3 mm. long, less than 0.5 mm. wide, the scutellum covering nearly the entire ventral surface, the dorsal surface convex. (PLATE 73, A. FIGURE 37.)

The specimens cited in the original description are undersized and can scarcely be called cespitose. They differ, therefore, very decidedly from the large specimens of the Santa Rita Mountains. They also differ decidedly in color, my specimens from southern Arizona being much lighter. Wooton's no. 6033 is especially dark colored, but this is easily accounted for by the abnormal rainfall of the season in which it was collected. The rains appeared very late that year and continued into the cool season. Grasses often show this excessive coloration when subjected to cooler nights than normal, either when growing later in season than usual or at high altitudes. The type specimens are so diminutive that they are really not at all representative of the species as it is commonly found. *Pringle* 413, *Nealley* 265, *Lemmon* 4638, well represent the common form of this species.



FIG. 37.—*Bouteloua parryi*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*–*f*, rudimentary second, third, and fourth florets; *g*, two views and cross section of caryopsis. *a*, Scale 7.5; *b*–*g*, scale 12.5. *a*–*f*, From *Griffiths* 7277; *g*, from *Wooton* 3065.

HERBARIUM SPECIMENS.

ARIZONA: *Mearns* 1121½, San Pedro River, Mexican Boundary Line. *Nealley* 265, Oracle. *Lemmon* 426 and 4638, "S. E. Arizona." *Griffiths & Thornber* 206, Santa Rita Mountains. *Griffiths* 1819, 3415, Mescal.

NEW MEXICO: *Cockerell* 16, Jarilla Junction.

TEXAS: *Scribner* in 1887.

MEXICO: *Schaffner* 1019 and 157, San Luis Potosí. *Pringle* 413, Chihuahua. *Wilkinson*, Santa Eulalia Mountains, Chihuahua. *Parry & Palmer* 943½, San Luis Potosí.

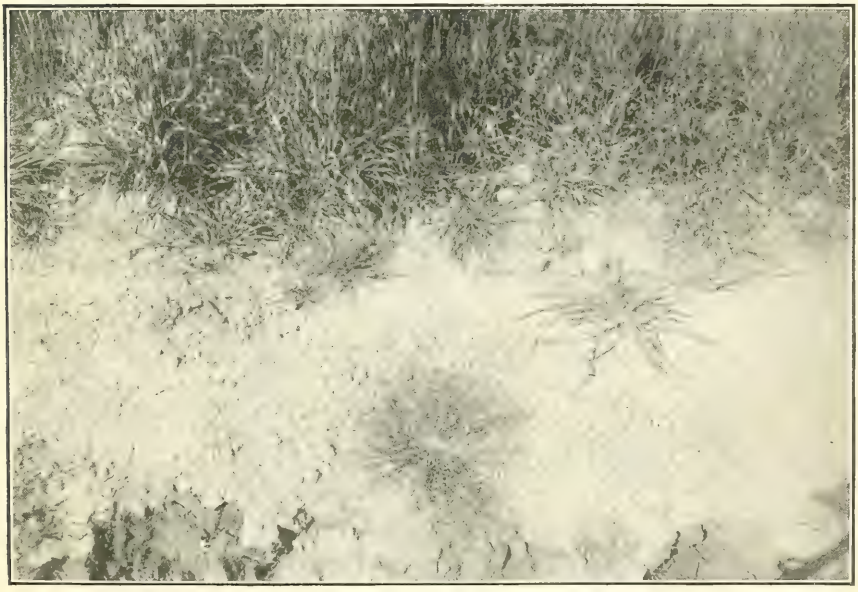
11. Bouteloua barbata Lag.

Bouteloua barbata Lag. Var. Cienc. **2**[4]: 141. 1805. This name has dropped out of recent literature, although it was correctly interpreted by Ruprecht, Roemer and

EXPLANATION OF PLATE 73.—A. A clump of *Bouteloua parryi* consisting of several plants with those around removed. In situations like this, where many plants are found together, the habit is different from that wherein it grows in more isolated scattered bunches. B. An unusually large isolated tuft of *Bouteloua barbata*, Adamana, Arizona.



A. LARGE PLANT OF BOUTELOUA PARRYI (FOURN.) GRIFFITHS.



B. BOUTELOUA BARBATA LAG.

Schultes, Kunth, and Steudel. A plant in the herbarium of the Botanic Garden at Madrid bearing this name in Lagasca's hand, is what in this country we have been calling *B. polystachya*. Of course this specimen is not the type, for Lagasca's first herbarium was burned, but this specimen named by him and his description, so far as it goes, applying to *B. polystachya*, leaves no doubt in my mind about the identity of the species.

Actinochloa barbata Roem. & Schult. Syst. Veg. **2**: 420. 1817. Based upon *Bouteloua barbata* Lag.

Eutriana? barbata Kunth, Rév. Gram. **1**: 96. 1829. Based upon *Bouteloua barbata* Lag.

Chondrosium polystachyum Benth. Bot. Voy. Sulph. 56. 1844. Through the kindness of the authorities at the Royal Botanic Gardens at Kew, I have been able to examine a liberal specimen of the type (*Barclay*, Magdalena Bay, Lower California). A specimen of the same collection is in the National Herbarium. Attention should be called to the fact that this is a very different species from the Palmer specimen [a] from the Yaqui River region of Sonora, collected in 1869, said by Munro to be "typical."

Bouteloua polystachya Torr. U. S. Rep. Expl. Miss. Pacif. **5**[2]: 366. *pl. 10.* 1857. Based upon *Chondrosium polystachyum* Benth.

Bouteloua pumila Buckl. Proc. Acad. Phila. **1863**: 93. 1863. The type (*Wright* 754, Texas) is in the herbarium of the Philadelphia Academy.

Chrondrosium exile Fourn. Mex. Pl. **2**: 137. 1881. The type (*Berlandier* 842) in the Paris Herbarium is *Bouteloua barbata*. It is referred there to the genus Chloris and credited to Fournier, but so far as I know was never published in that genus. The specimen is a narrow-spiked, short-awned form. The same number in the Vienna Herbarium is the same species and is named "*Bouteloua barbata* Rupr."



FIG. 38.—*Bouteloua barbata*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, *e*, rudimentary lemma and palet of second floret; *f*, rudiment of third floret. *a*, Scale 7.5; *b–f*, scale 20. From type specimen of *B. pumila*.

Chondrosium microstachyum Fourn. Mex. Pl. **2**: 138. 1881. The type (*Bourgeau* 667) is in the Paris Herbarium. Specimens of the same collection are also in the herbarium of the St. Petersburg Botanical Garden and in the National Herbarium, the former being labeled *B. oligostachya*.

Bouteloua microstachya Dewey, Contr. Nat. Herb. **2**: 531. 1894. Based on *Chondrosium microstachyum* Fourn. Dewey considers *B. arenosa* Vasey and *B. polystachya* Benth. as in part synonymous with this.

DESCRIPTION.

Plants exceedingly variable in both size and general aspect, erect when growing thickly, but prostrate when scattered, in favorable situations as much as 30 cm. high (as in *Griffiths* 6095) or prostrate, the tuft covering 3 or 4 square feet of surface, or consisting of single culms not over 3 cm. long; culms geniculate and freely branching when luxuriant, but mostly simple, especially if on sterile soil; sheaths loose, striate, smooth, comparatively short; blades short, flat, commonly 1 to 4 cm. long, divergent,

[a] See *Bouteloua sonorae*, page 389.

the ligule a ciliate, hairy ring; spikes 4 to 6 or 7, 1.5 cm. long; spikelets 25 to 40, about 3 mm. long over all, consisting of a floret and a rudiment; glumes hispid-keeled, short-awned, the awn subtended on either side by short, lanceolate-pointed teeth of the lamina of the glume, the first 2 mm., the second 3 mm. long; lemma 3.5 to 4 mm. long, densely hairy, having 3 equal, hispid awns, with 2 comparatively large, laminar teeth between them and a smaller one at either side; palet 3 mm. long, 2-awned and 4-toothed, bearing a few scattered hairs on the outside of the nerves; caryopsis oval, about 1 mm. long or less, rounded or slightly flattened on the back, the ventral surface nearly covered by the scutellum. (Plate 73, B, facing p. 382. Figures 38, 39.)

The species is variable, sometimes growing a foot high and sometimes only an inch (see plate), its size depending upon the character of the soil and the amount of rainfall. In our Southwestern States and in Mexico east of the Pacific coast region it has two quite distinct forms, one with short awns, the other with long awns, making the spike much wider in the latter case. The long-awned form very closely approaches *B. arenosa* of the Pacific coast of Sonora, but that species has still heavier spikes. Further study, however, may require the inclusion of that species here. I do not feel warranted at present in making a change in the nomenclature, for my field experience has not brought me in contact with the *arenosa* form.



Fig. 39.—*Boutcloua barbata*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, *e*, rudimentary second and third florets; *f*, two views and cross section of caryopsis. *a*, Scale 7.5; *b–f*, scale 15. From *Griffiths* 6095.

Pringle's 13626, *Schaffner* 183 and 187, *Rothrock* 352, *Wooton* 398, *Bourgeau* 667, *Metcalfe* 701, are all typical of this species, although showing some variation in the length of the awns and in the size of the plants, and consequently a decided difference in general aspect. Two specimens, from Lower California, *Brandegee*, San José del Cabo, 1890, and *Purpus*, Cape Region, are doubtfully referred here.

HERBARIUM SPECIMENS.

Arizona: *Toumey* in Seymour's Grasses 85, Tucson. *Hitchcock* 3668, Patagonia; 3489, Tucson. *Purpus* 8293, Beaver Creek. *Blumer* 1706, Paradise. *Mearns* 1121, San Pedro River near Mexican boundary; 2765, Quitovaquito. *Griffiths* 1897, Wilcox; 2009, Benson; 1646, Sulphur Spring Valley; 1524, Tucson; 3400, Santa Rita Forest Reserve; 3360, Tucson. *Knowlton* 194, San Francisco Mountains; *Lemmon* 4644; *Davidson* 41a, Clifton; *Griffiths & Thornber* 254, Santa Rita Mountains. *Jones* 6063, Buckskin Mountains. *Rothrock* 352, Cottonwood. *MacDougal* 571, Fort Verde. *Leiberg* 5922, Grand Canyon at Bright Angel Trail.

California: *Jones* 67a, Needles.

New Mexico: *Wooton* 2923, north of Chamita; 2023, Las Cruces; 3063, Organ Mountains; 398, Dona Ana County. *Metcalfe* 701, Silver City; 1395, Black Range. *Earle* 296, Roswell. *Plank* 15, Socorro. *Lemmon* 3147, Holbrook to Albuquerque. *Hitchcock* 3806, Organ Mountains. *Jones* 55a; *Tracy* 8190, Carlsbad. *Mearns* 2363, Dog Spring, Dog Mountains. *Mulford* 69, Florida Mountains.

Nevada: *Cooper* 2241, Fort Mojave.

Texas: *Palmer* 1356, Guadalupe; *Tracy* 8217, Big Springs; 8207, Fort Worth; *Cockerell* 15, Fort Bliss. *Jones* 641, 13a, and 4341, El Paso. *Havard* in 1882, Eagle Pass. *Nealley* 103, Laredo.

Utah: *Jones* 5702a, Junction; 5696, Cainville; 5652, Capitol Wash. *Thompson* 339.

Mexico: *Brandgee*, San José del Cabo, Lower California. *Palmer* 508, La Paz, Lower California and Guaymas; 857, Carmen Island; 714, Durango; 400 and 401, Saltillo. *Schaffner* 152 and 1017, San Luis Potosí; 153, Valley of Mexico. *Pringle* 490, Chihuahua; 11216 and 13626, Jimulco. *Barclay*, Lower California. *Parry & Palmer* 946, San Luis Potosí. *Smith* 957, San Antonio Valley, Oaxaca. *Pittier* 470, State of Durango.

12. Bouteloua arenosa Vasey.

Bouteloua arenosa Vasey, U. S. Dept. Agr. Div. Bot. Bull. **12**[1]: *pl. 34*[a]. 1890. The first use of the name was by Watson,[b] but no description is given. The type is *Palmer* 189, Guaymas, Sonora, Mexico, 1887, in the National Herbarium.

DESCRIPTION.

A tufted, smooth, erect or decumbent annual, with sparingly branched, simple or geniculate culms, 10 to 15 cm. long; sheaths striate, rather loose, especially in branching individuals, the ligule conspicuous, consisting of a white, ciliate fringe 1 to 1.5 mm. long; blades 3 to 4 cm. long, rather sparse in the majority of specimens, but plentiful in others; panicle racemose, 3 to 6 cm. long; spikes 2 to 4, about 1.5 cm. long, mostly recurved; spikelets 16 to 20, pectinate, consisting of a lower perfect floret and an upper rudiment; first glume 1 to 1.7 mm., the second about 3 mm. long, the keels very minutely scabrous, usually 2-toothed with short awns between the teeth; lemma 4-toothed, about 4.5 mm. long including the 3 long, scabrous, equal awns, about 3 mm. long, completely covered on the back with long, white hairs 1 mm. or more in length; palet 4-toothed, 3 mm. long, including the scabrous awns, about 1.3 mm. long, with a white, hairy, ciliate fringe outside of the nerves, the awns being a continuation of these; rudiment 5 mm. long, consisting of three approximately equal, scabrous awns, 3 mm. long, alternating with the obovate lobes of the lemma and supported upon a short, hairy-tufted stipe; caryopsis obovate, 1 mm. long, 0.4 mm. wide, the scutellum covering about two-thirds of the ventral surface. (Figure 40.)

The species is to be looked upon as a long-awned form of *B. barbata*, which appears to be characteristic of the coast of Sonora. Dr. Palmer's notes indicate that the type was collected in loose, sandy soil.

It is quite doubtful in my mind whether *B. arenosa* is really specifically distinct from *B. barbata*, but I hesitate to reduce it, because my experience in the field in this particular locality is very limited. It must be confessed, however, that there are forms of *B. barbata* in Arizona and New Mexico which approach this in the one character which has served to separate it; that is, the length of the awns. However, only the specimens enumerated below have awns as short as those of *B. barbata*, the Arizona forms referred to *B. barbata* having awns only two-thirds to three-fourths as long. We have here the same sort of differences that we have in *B. rothrockii* and its allies.

[a] The figure is very misleading.

[b] Proc. Amer. Acad. **24**: 81. 1889.

Besides several sheets of the type collection there are in the National Herbarium two specimens collected by Orcutt in Lower California in 1889 and 1890 and one by Hayes at "Puachio," Arizona, in 1858. All of these differ only in having longer awns from forms of *B. barbata* which I know in the field.



FIG. 40.—*Boutcloua arenosa*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, *e*, rudimentary second and third florets; *f*, two views and cross section of caryopsis. *a*, Scale 7.5; *b–f*, scale 20. From type specimen.

HERBARIUM SPECIMENS.

ARIZONA: *Hayes*, Puachio. *Mearns* 929, south of Bisbee.
CALIFORNIA: *Orcutt*, Colorado Desert.
TEXAS: *Buckley* in 1883.
MEXICO: *Palmer* 189, Guaymas. *Hitchcock* 3534, Hermosillo. *Orcutt*, Lower California in 1889.

13. Bouteloua trinii (Fourn.).

Chondrosium trinii Fourn. Mex. Pl. **2**: 136. 1881. A duplicate of the type (*Berlandier* 1427, Laredo, Texas), in the National Herbarium, and a photograph and fragment of the type from the herbarium of the Paris Muséum are before me.

Chondrosium (?) *polystachyum* Trin.; Fourn. Mex. Pl. **2**: 136. 1881. This herbarium name is given as a synonym of *Chondrosium trinii*.

Bouteloua trifida Thurb. in Wats. Proc. Amer. Acad. **18**: 177. 1883. The type, in the Gray Herbarium, is *Palmer* 1355, Monclova, Coahuila, Mexico, 1880. See also U. S. Dept. Agr. Div. Bot. Bull. **12**[1]: *pl. 46*. 1890; U. S. Dept. Agr. Div. Agrost. Bull. **7**: 224 and 225. *f. 206 and 207*. 1897.

Bouteloua burkii Scribn. in Wats. Proc. Amer. Acad. **18**: 179. 1883; Bull. Torrey Club **11**: 5. 1884. The type, as considered by Scribner in the latter publication, was collected at Laredo, Tex., by Mrs. Anna B. Nickels. This specimen appears to have been destroyed when Scribner's herbarium was burned. *Berlandier* 167, which is the first specimen cited by Watson, probably was burned at the same time, at least this does not appear to be now in the Gray Herbarium. *Berlandier* 1427, cited in the original description, is in the National Herbarium, *Curtiss* 3440* also cited, is in the herbarium of the Missouri Botanical Garden and the National Herbarium. See also U. S. Dept. Agr. Div. Bot. Bull. **12**[1]: *pl. 36*. 1890.

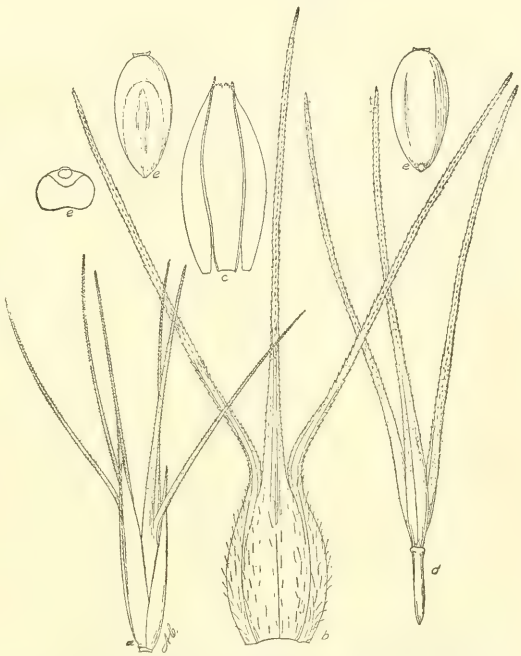


FIG. 41.—*Bouteloua trinii*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, rudiment; *e*, two views and cross section of caryopsis. *a*, Scale 7.5; *b*–*e*, scale 12.5. From *Griffiths* 6104.

Watson's paper [a] was published August 23, 1883. Here he describes *B. trifida* Thurb., basing it upon *Palmer* 1355, Monclova, Coahuila, Mexico. He also lists *Parry & Palmer* 945 and *Wright* 749, 2020, and 2022, and describes *B. burkii* Scribn., basing it upon *Berlandier* 167 and 1427, and *Curtiss* 3440. Scribner [b] publishes the same species again. Under *B. trifida* Scribner lists: "Texas and New Mexico; G. R. Vasey, Mexico; Dr. E. Palmer No. 1355, 1880." Under *B. burkii* he lists the following: "Laredo, Texas; Mrs. Anna B. Nickels; communicated to me by Mr. Isaac Burk, of Philadelphia, for whom the species is named. Sandy plains, Upper Concho, West Texas; J. Reverchon; No. 3440*, Curtiss's Distribution North American Plants."

In the National Herbarium a specimen collected by Letterman, Laredo, Tex., July, 1882, is marked the type of *B. burkii*, and another collected by G. R. Vasey, El Paso, Tex., 1881, the type of *B. trifida*, both in Scribner's hand.

DESCRIPTION.

A variable, low, delicate, cespitose perennial, with comparatively naked culms, 12 to 15 cm. high, but very variable in size, erect, or, in old, undisturbed plants,

[a] Proc. Amer. Acad. **18**: 176–180. [b] Bull. Torrey Club **11**: 5. January, 1884.

geniculate at the very base; sheaths close, striate, smooth or very minutely roughened-hispidulous, with ciliate-fringed ligule and minutely pubescent, hispid blades, bearing a few long, scattered, papillose hairs, divaricate, 1 to 2 cm. (*Letterman*, Laredo, 1882) to 3 to 7 cm. long (*Griffiths* 6338); panicle racemose, 4 to 7 cm. long, bearing 3 to 7 spikes, 1 to 1.3 cm. long, bearing about 12 pectinately arranged spikelets 7 to 8 mm. long; spikelets consisting of one fertile floret and a rudiment; glumes about equal, smooth, keeled, about 2.5 mm. long; lemma hairy, 4 to 5 mm. long, bearing 3 scabrous awns about 3 mm. long; palet 2-keeled, not awned, about 1.5 mm. long; rudiment consisting of 3 hispid, equal awns, enlarged at base, about 4 mm. long, upon a naked stipe 1 mm. long or less; caryopsis obovate, 0.8 mm. long, 0.3 mm. wide, the scutellum somewhat oval, two-thirds the length of seed. (PLATES 74, A; 78. FIGURES 41, 42.)

Like many other species of the genus this is very variable in size and general aspect. The specimens marked type in the National Herbarium, as mentioned above, while not the nomenclatorial types, are nevertheless typical of what was intended to be published under these two names. For nomenclatorial purposes I consider them as

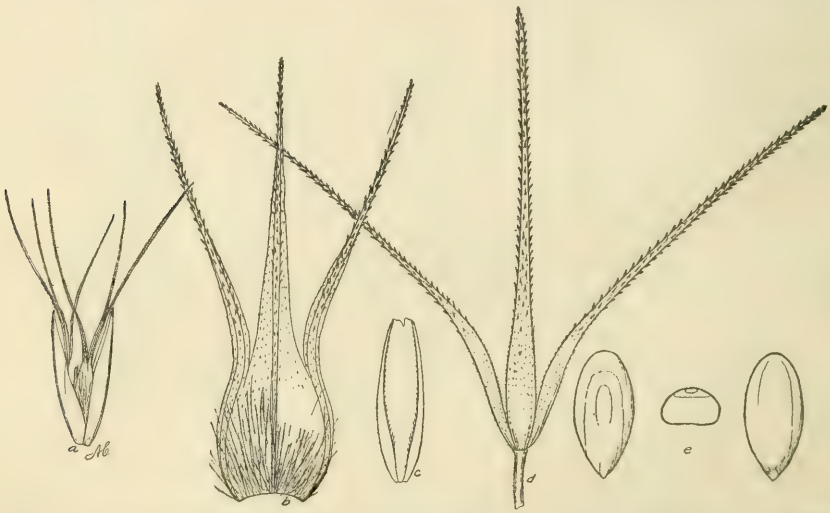


FIG. 42.—*Bouteloua trinii*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, rudiment; *e*, two views and cross section of caryopsis. *a*, Scale 7.5; *b–e*, scale 15. *a–d*, From *Letterman*, Laredo, Tex. (typical of *B. burkii*); *e*, from *Griffiths* 6338.

good as types. *Bouteloua burkii* and *Chondrosium trinii* are the same form of plant; that is, the shorter awned, more leafy plant, with longer, laxer leafage.

Westward from about the region of Del Rio, Texas, the species is inclined to assume a slightly different aspect. Especially is this true from the region of El Paso to Arizona. The plant is somewhat dwarfed, the leaves are fewer, shorter, and more rigid, and the awns slightly longer. In short, the same differences occur in this species upon entering more arid situations as are found in *B. gracilis* in southern California where the leaves become more radical, shorter, and more rigid, compared with those of more humid sections.

In the Rio Grande region the species is very important from the stockman's standpoint, for it often constitutes the sum total of the forage upon the alluvial soils of the shallow ravines and also extends onto the rocky knolls and ridges.

When closely grazed it is short, with divaricate, crowded leaves near the base and comparatively naked culms. When unmolested and consequently somewhat shaded

EXPLANATION OF PLATE 74.—A. *Bouteloua trinii* as it grows in arid situations near Andrade, Arizona. Here we always have the form described as *B. trifida*. B. An extraordinarily large bunch of *Bouteloua eriopoda* from the Santa Rita Mountains, Arizona.



A. BOUTELOUA TRINII (FOURN.) GRIFFITHS.



B. BOUTELOUA ERIOPODA TORR.

by old growth at its base, the leaves are more lax, ascending, and longer, and the culms are more leafy above.

Specimens are abundant in American herbaria. They are usually referred to *B. burkii* and *B. trifida* in about equal numbers. The range of the species is from the Rio Grande region of Texas southward to San Luis Potosí and westward to Tucson, Arizona.

HERBARIUM SPECIMENS.

The following are typical of *B. burkii:*

TEXAS: *Reverchon* 162, Coleman and Tom Green Counties; 1361½ and 1361,[a] Llano; 1408, Sabinal Canyon; 3440, Upper Concho, in Curtiss N. Amer. Plants. *Jermy*, Bexar County. *Smith* 97, San Diego. *Tracy* 8230, Colorado; 8896, Kingsville. *Nealley*, Cotula, 1888. *Piper*, Kingsville, 1906. *Letterman*, Laredo, July, 1882. *Berlandier* 1427.

MEXICO: *Pringle* 1974 and 11735, Monterey; *Palmer* 370, Victoria.

The following herbarium specimens are typical of *B. trifida* (PL. 74, A.):

ARIZONA: *Pringle*, mesas near Tucson, 1884. *Griffiths* 2448, Tucson.

NEW MEXICO: *Wright* 2022 of 1851–52.

TEXAS: *Vasey*, El Paso, 1881. *Reverchon* [b] 1408 (Texas Plants), Sabinal Canyon.

MEXICO: *Palmer* 522 and 402, Saltillo.

The following specimens appear to stand midway between the two forms in some characters, usually due to long awns combined with softness and laxity of leafage:

ARIZONA: *Lemmon*, Hackberry 1889.

TEXAS: *Canby* 270, Spofford Junction. *Reverchon* 37; 361, Llano (Texas Plants); 1408, Sabinal Canyon. *Jermy* 212, Bexar County. *Plank*, El Paso, 1894; 1, Llano. *Havard* 30, mouth of Pecos. *Mearns* 1215, Fort Clark.

MEXICO: *Pringle* 412, Chihuahua. *Palmer* 552, Victoria; 1355, Monclova. *Parry & Palmer* 945, San Luis Potosí. *Wilkinson*, Santa Eulalia Plains, Chihuahua, 1885. *Mearns* 1201, La Noria, Sonora.

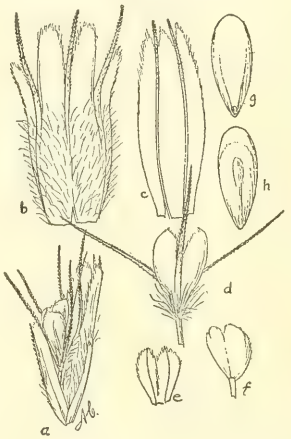


FIG. 43.—*Bouteloua sonorae*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, *e*, rudimentary lemma and palet of second floret; *f*, rudiment of third floret; *g*, *h*, two views of caryopsis. *a*, Scale 7.5; *b–h*, scale 10. From type specimen.

14. Bouteloua sonorae sp. nov.

DESCRIPTION.

A low, spreading, or half-erect perennial, 12 to 15 cm. high; culms simple, stoloniferous or simply geniculate; sheaths close, striate, smooth, the ligule a rather long fringe of white hairs; blades mostly radical, narrow, short, acuminate, 5 to 10 cm. long, decreasing upward to often 1 cm. long, revolute; panicle racemose, about 4 cm. long; spikes 2 to 4, mostly 4, about 12 to 14 mm. long, recurved at the apex; spikelets about 30, pectinate, about 2.5 mm. long, consisting of a lower perfect floret and an upper rudiment; glumes smooth except for a few long white hairs on the keel, not awned, the second 1.5 mm. long, the first a little shorter; lemma hairy, 3-nerved, shortly 3-awned, 2.3 to 2.5 mm. long, including awns; palet concave, shortly 2-awned, a trifle shorter than its lemma; rudiment of 3 awns interspersed with short, blunt scales upon a short, hairy-tufted stipe, about 0.5 mm. long; caryopsis not seen. (FIGURE 43.)

[a] Typical *B. burkii* and *B. trifida* are on the same sheet of no. 1361, Texas Plants.

[b] Three sheets of this are placed in as many groups.

The species is to be looked upon as a perennial *B. barbata*, a native of the west coast of northern Mexico. The type is Palmer's Yaqui River specimen of 1869 in the National Herbarium. *Palmer* 751, Alamos, Mexico, 1890 and *W. G. Wright* 1322 from the headwaters of Mazatlan River are distinctly stoloniferous, while *Hitchcock* 3552, Guaymas, Mexico, is simply geniculate and a much larger plant than any of the others. The same is true of *Chase* 5509 from near Guaymas.

15. Bouteloua eriopoda (Torr.) Torr.

Chondrosium eriopodum Torr. in Emory, Mil. Reconn. 154. 1848.

Bouteloua eriopoda Torr. U. S. Rep. Expl. Miss. Pacif. **4**: 155. 1856. Based upon *Chondrosium eriopodum*. See also U. S. Dept. Agr. Div. Bot. Bull. **12**[1]: *pl. 37*. 1890; U. S. Dept. Agr. Div. Agrost. Bull. **7**: 217. *f. 199*. 1897.

Bouteloua brevifolia Buckl. Proc. Acad. Phila. **1862**: 93. 1862. Asa Gray[a] reviews Buckley's descriptions and refers this to *B. eriopoda* Torr. and shows that it was based upon Wright's no. 748 and Fendler's no. 950 (not 946 as on ticket in the Philadelphia Academy Herbarium).

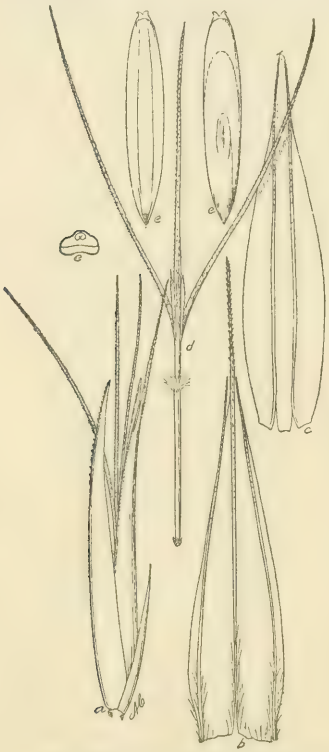


FIG. 44.—*Bouteloua eriopoda*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, rudiment; *e*, two views and cross-section of caryopsis. *a*, Scale 7.5; *b–e*, scale 10. From *Griffiths* 7002.

DESCRIPTION.

A cespitose perennial, growing commonly in large bunches, separated by intervals of a few inches to a few feet of bare ground, or occasionally a weedy annual, but seldom in shade of shrubs; culms geniculate, rather weak, woolly, 40 to 60 cm. long, commonly branched, and in warmer localities sparingly perennial, with close, striate, smooth sheaths, small ciliate-fringed ligule, and narrow, convolute, smooth blades; panicle racemose, 10 to 15 cm. long; spikes 3 to 8, commonly 4 or 5, 2 to 3 cm. long; spikelets 12 to 20, 7 to 10 mm. long, loosely pectinate, consisting of one lower fertile floret and an upper rudiment; glumes very unequal, the first about 3 mm., the second about 7 mm. long, keeled, smooth, or the second minutely scabrous at the apex; lemma minutely hairy below, 3-awned, the lateral awns very short, the central equaling those of the rudiment, hispid, 2 mm. long; palet awnless, acuminate, about 5 mm. long; rudiment consisting of 3 equal, hispid awns 4 mm. long, united at base by very minute scales and supported upon a slender, smooth stipe 2 mm. long, hairy-tufted at each end; caryopsis cylindrical-oblong, 2.5 to 3 mm. long, 0.25 to 0.35 mm. wide, the scutellum covering three-fourths of the ventral surface. (PLATE 74, B, facing p. 388. FIGURE 44.)

The lax, pectinate inflorescence and woolly culms readily distinguish this species. In publications of the United States Department of Agriculture it has usually been called "woolly-foot" but in portions of the Rio Grande Valley of New Mexico, where

[a] Proc. Acad. Phila. **1862**: 334. 1863.

it is most abundant, "black grama" is the name by which the stockmen know it. In and adjacent to the Mesilla Valley it occupies large stretches of the open, gently sloping country between the rugged upper foot-hills and the brushy regions of the lower foothills and mesas above the bottom lands. The crop here in exceptionally favorable years is heavy enough to be mown for hay. No other region is known which makes such a heavy crop, although it is an abundant and familiar grass throughout the arid Southwest and extends far into Mexico.

There has never been much confusion regarding its identity, and although very variable the species is easily distinguished when once recognized. *Wright* 18 and 748; *Jones* 54a; *Pringle* 411; *Mearns* 2267 and 2089; and *Wooton* 458 are typical.

HERBARIUM SPECIMENS.

ARIZONA: *Griffiths* 1825, Mescal; 1669, Rincon Mountains; 3395 and 3367, Santa Rita Forest Reserve. *Jones* 6067, Pipe Spring; 4262, Bowie; *Griffiths & Thornber* 1, Santa Rita Forest Reserve; 233, Empire Ranch. *Leibcrg* 5931, Bright Angel Trail, Grand Canyon. *Mearns* 865, south of Bisbee; *Rusby* 892, Yavapai County. *Purpus* 8276, Beaver Creek. *Toumey*, Chiricahua Mountains.

NEW MEXICO: *Plank* 18 and 5, Socorro. *Griffiths* 3337, Deming. *Mearns* 2333, Dog Mountains. *Metcalfe* 631, 1451, Kingston; *Wright* 2018; *Jones* 54a, Albuquerque. *Wooton & Standley*, Tortugas Mountains; 3973, east of Dona Ana Mountains. *Hitchcock* 3740, Deming; 3787, Organ Mountains. *Wooton* 458, Las Cruces.

TEXAS: *Plank* 69, El Paso. *Tracy* 8283, Barstow. *Carleton* 417, Oldham County.

MEXICO: *Pringle* 411, Chihuahua. *Wilkinson* 348, Santa Eulalia Plains, Chihuahua. *Mearns* 2089, base of San Luis Mountains, Mexican Boundary.

16. Bouteloua rothrockii Vasey.

Bouteloua polystachya major? Vasey in Wheeler, Rep. U. S. Surv. 100th Merid. **6**: 287. 1878. This is based upon Rothrock's no. 691, Sonoyta Valley, Arizona, September, 1874. The specimen is in the National Herbarium. It is the narrow-spiked form, typical of *B. micrantha* Scribn. & Merr. See also Vasey, Grasses U. S. 33. 1883, and Descr. Cat. Grasses 63. 1885. Both this variety and *B. rothrockii* are listed in the former reference.

Bouteloua rothrockii Vasey, Grasses U. S. 33. 1883, name only; Contr. Nat. Herb. **1**: 268. 1893, containing the first description. The type is Rothrock's no. 347, Cottonwood, Arizona, 1874. See also U. S. Dept. Agr. Div. Agrost. Bull. 7: 221. *f. 203.* 1897.

Bouteloua micrantha Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Circ. **32**: 8. 1901. Based upon *Griffiths* 1556, Fort Lowell, Arizona, September, 1900. This is a narrow-spiked form of *B. rothrockii* grown under favorable circumstances in an irrigated, poorly cultivated field. It is typical of *B. polystachya major ?* Vasey.

DESCRIPTION.

A tufted, erect, sparingly branched, smooth, short-lived perennial, 25 to 50 cm. high; sheaths striate, smooth, rather tightly fitting but often open at maturity, the ligule reduced to a ciliate fringe; blades abundant toward the base of culm, 6 to 10 cm. long, 2 to 3 mm. wide, smooth or usually with a few long, scattered, delicate, papillose hairs on the upper surface and edges, the margin minutely serrate; panicle racemose, 10 to 25 cm. long; spikes 4 to 10 or 12, 2.5 to 3 cm. long and 5 mm. wide; spikelets pectinate, 40 or 50, about 6 mm. long, including awns; glumes minutely scabrous, keeled, the first about one-half the length of the second and with an awn about 1 mm.

long; lemma about 5 mm. long, loosely hairy, with long, white hairs, the four teeth fringed or frayed into minute, hair-like teeth, with 3 scabrous awns, 1 to 1.5 mm. long, palet 4-notched, two-nerved with two scabrous awns, hairy on the edges and laciniate at apex like the lemma, 4 mm. long; rudiment consisting of two rudimentary florets, the lower composed of rudimentary scale-like glumes and three long, scabrous awns (about 3 mm. long), subtended by a tuft of long, straight, white hairs, all borne upon a naked stipe 1 mm. long; second rudiment consisting of scale-like glumes upon a naked, short stipe; caryopsis ovate to obovate, about 1.25 mm. long, the scutellum covering nearly the entire ventral surface. (Plate 75, A, B. Figures 45, 46.)

There are large areas in southern Arizona and neighboring regions where this is the most important grass of the stock ranges. It inhabits the upper mesas and the

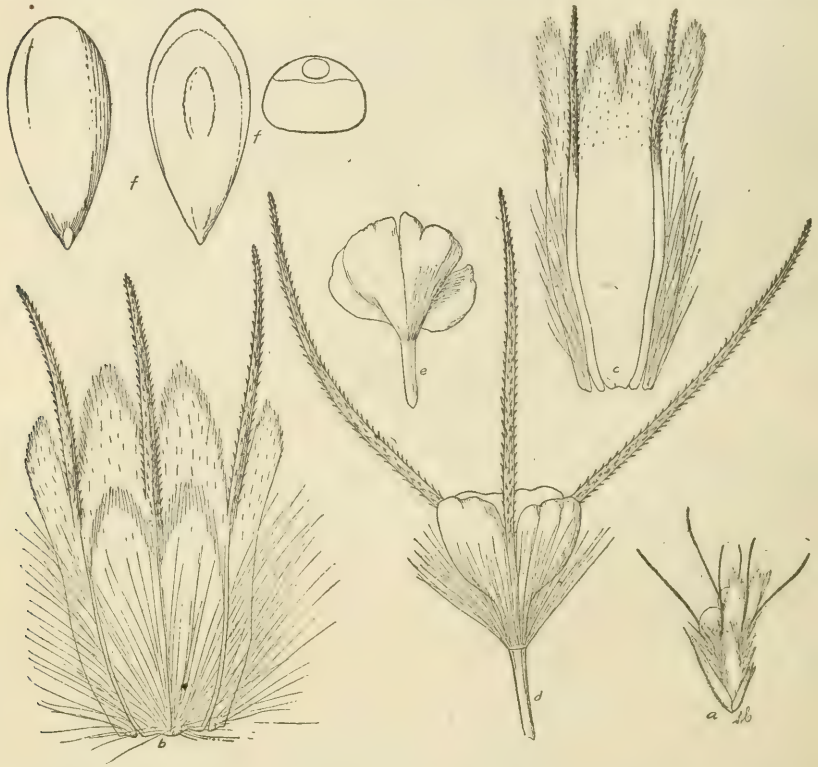
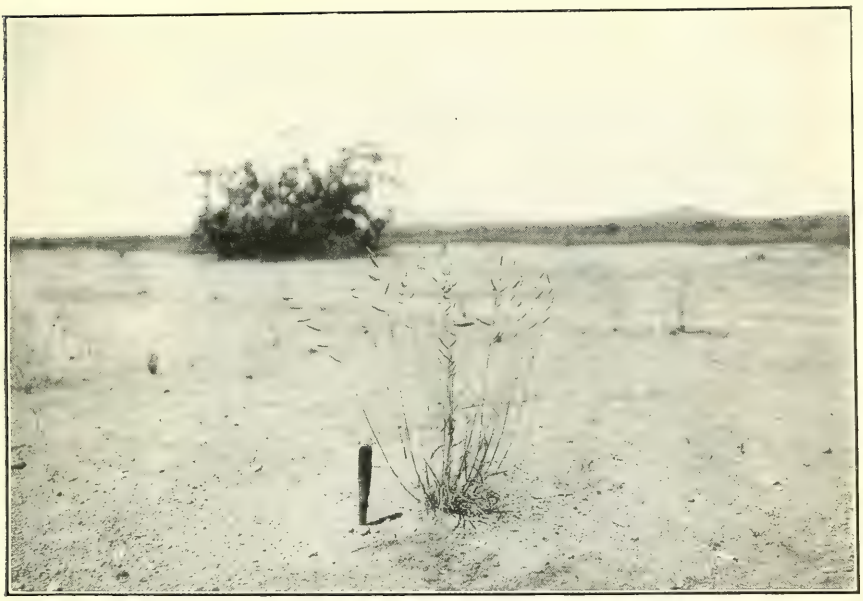


Fig. 45.—*Bouteloua rothrockii*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, *e*, rudimentary second and third florets; *f*, two views and cross-section of caryopsis. *a*, Scale 7.5; *b–f*, scale 20. *a–e*, From type specimen; *f*, from *Griffiths* 7185.

gentle, brushless slopes of the foothills during the summer rainy season, July to September, often to the exclusion of all other species. It is a very characteristic species, and although often appearing to intergrade with *B. barbata* it is very distinct and easily distinguished in the field. There are many specimens, however, which are very difficult to separate from *B. barbata* on the herbarium sheet. When the

Explanation of Plate 75.—A. An isolated tuft of *Bouteloua rothrockii* on desert east of Tucson, Arizona. B. A large native crop of *Bouteloua rothrockii* in southern Arizona. This area had not been pastured for five years.



A. ISOLATED PLANT OF BOUTELOUA ROTHROCKII VASEY.



B. DENSE GROWTH OF BOUTELOUA ROTHROCKII.

species is nearing maturity, the landscape is tinted reddish brown by the abundant spikes. In some sections it grows so abundantly that ranchers consider it profitable to cut it for hay. So far as my own observation goes it never yields over one-half ton to the acre of clean, current year's growth (Pl. 75, B). In southern Arizona, upon a rainfall of 12 to 18 inches, it grows about 8 inches in the growing season, July to September.

Bouteloua rothrockii is not a grass that withstands close pasturage well. Being a short-lived perennial and a comparatively poorly rooted species, it is easily pulled up and trampled out. The best growths of it today are found in those regions which are at a considerable distance from water available for stock.

It grows in bunches of a few culms to scores of culms, but so far as my observation goes never makes any semblance of a turf. When it happens to grow on partly cultivated ground or in other favorable situations, the bunches may grow very large and the outer culms of the stool become geniculate and even rooted at the joints. Some

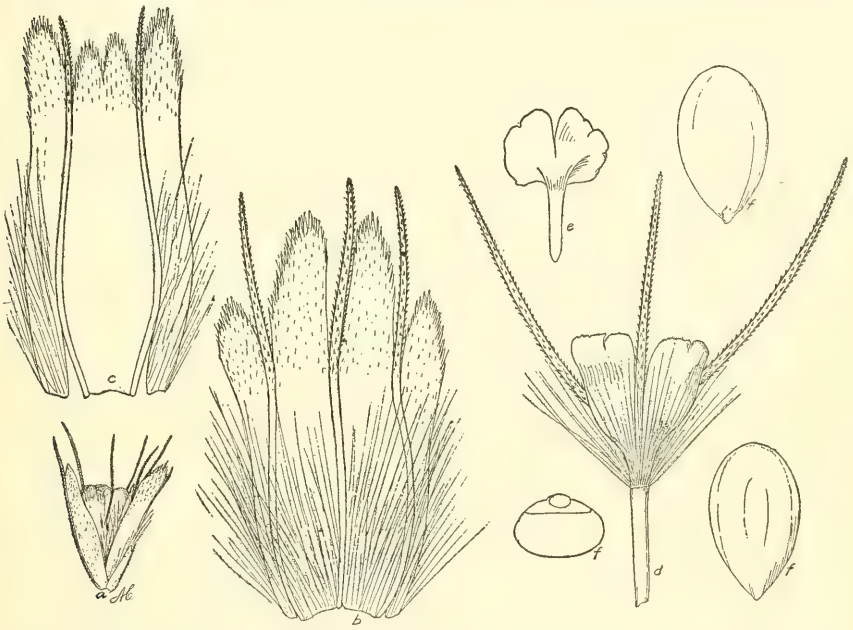


FIG. 46.—*Bouteloua rothrockii*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, *e*, rudimentary second and third florets; *f*, two views and cross-section of caryopsis. *a*, Scale 7.5; *b–f*, scale 20. From type specimen of *B. micrantha*.

of my specimens from cultivated ground in the upper Santa Cruz Valley of Sonora show this form of the plant beautifully.

My conception of the species is well illustrated by the specimens cited below. *Rothrock* 691 and *Griffiths* 1556 have narrow spikes and smaller floral parts throughout than the common typical form (Pl. 75, A).

Palmer's no. 244 and *Pringle* 221 very well represent the common form. *Brandegee*, Culiacan, Mexico, October, 1904, and *Palmer* 204, 1534, and 1761, are geniculate forms. *Purpus* 94 and *Pringle*, Arizona, in 1884 without number, represent forms which have about the same relation to the typical species as *B. arenosa* has to *B. barbata*. In these the awns are exceptionally long and the spike very wide.

HERBARIUM SPECIMENS.

ARIZONA: *Hitchcock* 3685, Patagonia; 3480, Tucson; 3733, Benson. *Griffiths* 1556, Fort Lowell; 3361, near Tucson; 3402, Santa Rita Forest Reserve; 1785, Rincon Mountains. *Mearns* 1026, 1064, and 856½, south of Bisbee. *Griffiths & Thornber* 199 and 9, Santa Rita Mountains. *Purpus* 94, Antelope. *Pringle* in 1884 near Mexican Boundary. *Rothrock* 691, Sonoyta Valley; 347, Cottonwood. *Nealley*, Tanque Verde. *Wilcox*, Fort Huachuca. *Jones* 4014, Flagstaff. *Lemmon* 429, 430. *Toumey* 807, and 512, Tucson.

UTAH: *Jones*, Moab.

MEXICO: *Hitchcock* 3583 and 3536, Hermosillo; 3523, Llano. *Palmer* 235, 166, and 204, Guaymas; 791, Agiabampo; 1543, Culiacan; 1761, Ymala. *Brandegee*, Culiacan.

17. Bouteloua karwinskii (Fourn.).

Chondrosium karwinskii Fourn. Mex. Pl. **2**: 137. 1881. The type is *Karwinski* 1479 from "Cañon de las Minas et Victoria," Mexico. This number was not found in the Paris Herbarium. My interpretation is based upon a panicle and two leaves of this number from the herbarium of the St. Petersburg Botanical Garden. Hemsley [a] lists this as one of Fournier's unidentified species, but gives the range as extending from Texas to South Mexico and a specific locality as La Miquiguana. I have seen no collections of the species except as noted below and can not say anything about the basal portion of the type plant nor its duplicates, having seen only a panicle and some leaves. These, however, agree so well with recent collections that I have no hesitancy in referring them here.

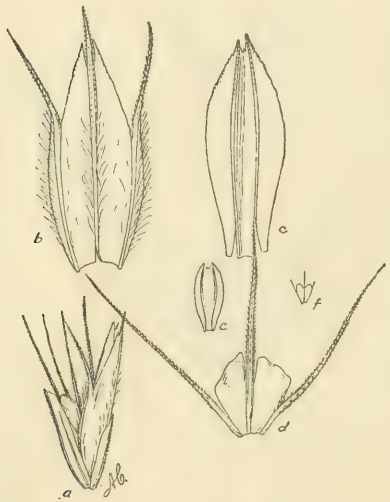


FIG. 47.—*Bouteloua karwinskii*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, *e*, rudimentary lemma and palet of second floret; *f*, rudiment of third floret. *a*, Scale 6.66+; *b*-*f*, scale 10. From *Karwinski* 1479, in St. Petersburg Herb.

DESCRIPTION.

An erect, cespitose, gray-glaucous, rigid perennial, with stout, short, rhizomatous base; culms simple, erect, 20 to 30 cm. high; sheaths striate, smooth, close, the ligule reduced to a few long, white hairs; blades narrow, mostly basal, variable, about 7 cm. long and 1 to 1.5 mm. wide; panicle racemose, about 10 cm. long; spikes 12 to 14 mm. long and 5 or 6 in number; spikelets pectinate on a flattened, short, hairy, zigzag rachis, consisting of a lower perfect and an upper three-awned rudiment, with scales and awns arising from a naked stipe about 1 mm. long; glumes smooth, the second about 2 mm. long, the first a little shorter, acuminate, scarcely awned; lemma 2 to 2.5 mm. long, pubescent, with 3 equal awns; palet about the length of its lemma, with 2 very short awns, plicate; caryopsis not seen. (PLATE 76. FIGURE 47.)

[a] Biol. Centr. Amer. Bot. **3**: 564. 1885.

EXPLANATION OF PLATE 76.—Natural habitat of *Bouteloua karwinskii*, *B. trinii*, and *B. stolonifera* among vegetation consisting largely of Cereus, Opuntia, Jatropha, etc., east of San Luis Potosí, Mexico.



HABITAT OF BOUTELOUA KARWINSKII (FOURN.) GRIFFITHS, B. TRINII (FOURN.) GRIFFITHS, AND B. STOLONIFERA SCRIBN.

The species appear to be native from San Luis Potosí northward. It is distinguished by its strong, harsh, woody base and by its spikes, which, although they resemble those of *B. barbata*, are slightly wider and shorter.

The first material seen was collected by myself near Alonzo, Mexico, March 14, 1905 (no. 7650). All specimens were of the previous year's growth, and consequently not satisfactory. Recently Lloyd has contributed very materially to a knowledge of the species by two collections (nos. 170 and 183) from Hacienda de Cedros, in northern Zacatecas. These and a panicle of a duplicate of the type are all the material which has been seen.

18. Bouteloua alamosana Vasey.

Bouteloua alamosana Vasey, Contr. Nat. Herb. 1 : 115. 1891. Edward Palmer's no. 698, Alamos, Sonora, Mexico, September 10 to 30, 1890, is the type.

DESCRIPTION.

A tufted, sparingly hairy annual with geniculate, ascending or prostrate, sparingly branched culms, 4 to 20 cm. high; sheaths striate, rather loose, with scattered, papil-

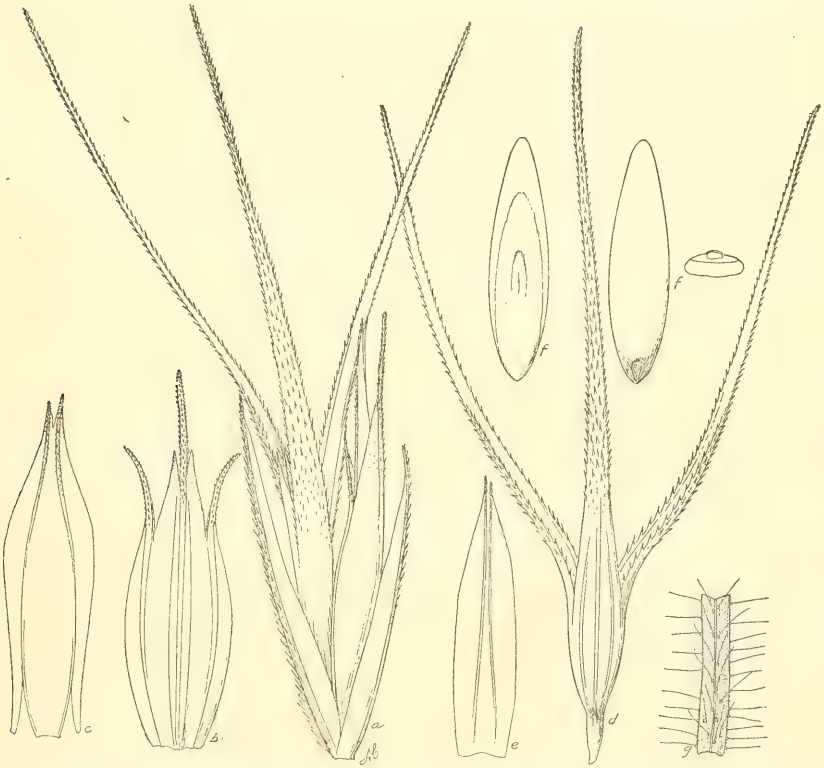


FIG. 48.—*Bouteloua alamosana*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, *e*, rudimentary lemma and palet of second floret; *f*, two views and cross-section of caryopsis; *g*, portion of leaf blade. *a–f*, Scale 7.5; *g*, scale 2.5.

lose hairs, especially near the edges, the ligule consisting of a white, ciliate fringe; blades minutely hispid, especially above, and bearing long, papillose hairs at regular intervals on the margins and scattered and less numerous hairs on the surfaces; panicle racemose, 2.5 to 4 cm. long; spikes 3 to 5, 10 to 15 mm. long, very similar to those of *B. texana*, containing 3 to 5 spikelets, these often consisting of one floret and a rudi-

ment, this in the proximal spikelet very much reduced; first glume 5 mm., the second 6 mm. long, scabrous-keeled; lemma 6 to 7 mm. long, 3-awned, the central awn about 1 mm. longer than the lateral, smooth, the awns scabrous; palet 2-awned, smooth, the awns scabrous; rudiment consisting of a staminate floret, the lemma bearing 3 long, scabrous awns, about 11 mm. long, lateral awns about 2 mm. shorter; palet similar to but smaller than that of the perfect floret; caryopsis cylindrical-ovate, 4 mm. long, 0.75 mm. wide, the large scutellum three-fourths the length of the entire caryopsis or more. (FIGURE 48.)

The type specimens furnish most of the knowledge which we have of this species, which grows upon rocky ridges on the Pacific coast of the State of Sonora, Mexico. It is very distinct from any of the other species. It resembles *B. aristidoides* in general habit but is a coarser, more leafy plant, and the spikes are more like those of *B. texana*.

Judging from the material in the National Herbarium this should be found commonly on the Pacific coast of Mexico, south from the State of Sonora. Besides the type specimens there is one collected by Earl Flint in Granada, Nicaragua, in February, 1868, which is at least very close to this species. Confirmatory material from Nicaragua is necessary.

19. Bouteloua aristidoides (H. B. K.) Griseb.

Dinebra aristidoides H. B. K. Nov. Gen. & Sp. **1**: 171. 1816. The plate of this [a] in a later volume identifies the species without doubt.

Atheropogon aristidoides Roem. & Schult. Syst. Veg. **2**: 415. 1817. Based upon *Dinebra aristidoides* H. B. K. See also Spreng. Syst. Veg. **1**: 293. 1825; Fourn. Mex. Pl. **2**: 139. 1881.

Eutriana aristidoides Trin. Gram. Unifl. 242. 1824. Based upon *Atheropogon aristidoides* H. B. K. See also Steud. Syn. Pl. Glum. **1**: 216. 1854.

Dineba hirsuta Presl, Rel. Haenk. **1**: 292. 1830. The type specimen is in the herbarium of the National Museum at Prague.

Eutriana ? hirsuta Kunth, Enum. Pl. **1**: 280. 1833. Based upon *Dineba hirsuta* Presl.

Aristida unilateralis Willd.; Steud. Nom. Bot. ed. 2. **1**: 132. 1840. A herbarium name of Willdenow published as a synonym of *Eutriana aristidoides*.

Bouteloua aristidoides Griseb. Fl. Brit. W. Ind. 537. 1864. Based on *Dinebra aristidoides* H. B. K. See also U. S. Dept. Agr. Div. Bot. Bull. **12** [1]: *pl. 35*. 1890; U. S. Dept. Agr. Div. Agrost. Bull. **7**: 214. *f. 196*. 1897.

Bouteloua gracilis Hook.?; Vasey in Wheeler, Rep. U. S. Surv. 100th Merid. **6**: 287. 1878, not Lag. 1840. The type is Rothrock's no. 701.

Bouteloua ciliata Griseb. Abh. Ges. Wiss. Göttingen **19**: 302. 1879 (Symb. Fl. Argent.). The type specimen, *Lorenz & Hieronymus* 352, from Juramento, Argentina, is in the Grisebach Herbarium.

Triathera aristidoides Nash in Small, Fl. Southeast. U. S. 137. 1903.

DESCRIPTION.

A tufted, erect or decumbent, smooth annual, with upright or geniculate culms, altogether too variable in size to permit of the preparation of lineal descriptions of any value; sheaths loose, especially on branching culms, striate, the lower one-third to one-half the length of the internode, the upper sometimes nearly as long, this depending upon the character of the season; ligule reduced to a membranaceous line or slightly fimbriate, with a few scattered hairs; blades small, few, 2 to 7 cm. long, with a few scattered hairs on the upper surface; panicle variable, 2 to 7 or 8 cm. long, but often in vigorous plants 15 cm. long, bearing normally 10 to 14 spikes, but under

[a] Op. cit. **7**: *pl. 695*. 1825.



A. LARGE PLANT OF BOUTELOUA ARISTIDOIDES (H. B. K.) GRISEB.



B. SAME SPECIES ON DESERT MESAS.

unfavorable conditions sometimes reduced, in stunted plants, to 2 to 4; spikes pedunculate, the peduncles about 1 mm. long, these, together with the rachis densely white-hairy over the entire surface or only on the angles, the pubescence diminishing in quantity distally to only scattering hairs upon the distal prolongation of the rachis; spikelets 2 to 4, the lowermost more or less aborted, loosely arranged, about 2 mm. apart, consisting of a perfect floret and a rudiment, this reduced or usually absent in the lower spikelet; first glume 1.5 to 2 mm., the second 5 to 6 mm. long, minutely scabrous-keeled, both narrow, acuminate; lemma with three, very short, nearly equal, minutely scabrous awns, pubescent, mostly on the 3 nerves, 6 to 8 mm. long; palet smooth, with two very short, very minutely scabrous awns, about 5 to 6.5 mm. long; rudiment consisting of 3 long, scabrous awns upon a hairy stipe, 1 mm. long, bearing a tuft of longer hairs at its apex, the central awn slightly glumaceous at base and about 2 mm. shorter than the lateral, the whole rudiment being about 7 mm. long; caryopsis cylindrical-oblong, 3 mm. long, 0.4 mm. wide, grooved on the dorsal surface, the scutellum about three-fourths the length of the ventral surface. (Plate 77, A, B. Figure 49.)

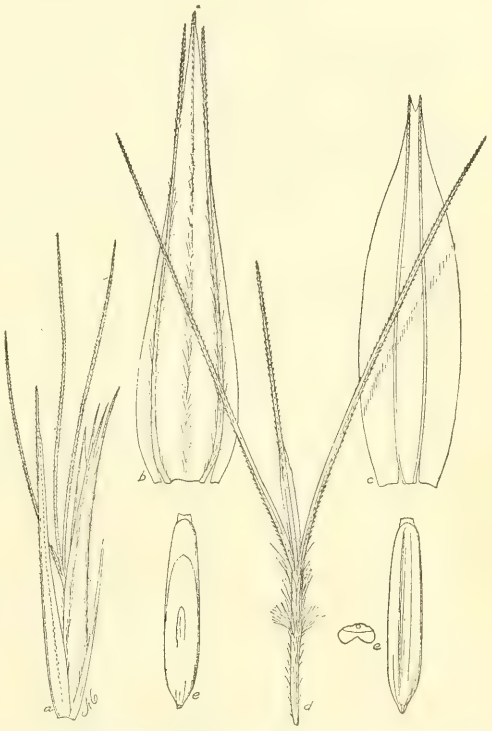


Fig. 49.—*Bouteloua aristidoides*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, rudiment; *e*, two views and cross section of caryopsis. *a*, Scale 7.5; *b–e*, scale 10. From *Griffiths* 7308.

The species inhabits the drier desert mesas and foothills from western Texas to the Pacific coast and is as variable as the seasons and conditions in this most variable region. Often it will mature its seed upon a single culm 1 or 2 cm. high, or it may produce plants with 50 culms 70 cm. in height. Often the spikes are not over 3 or 4 mm. in length and produce but a single seed, while in *Palmer* 51 some spikes are fully 2.5 cm. in length. The habits of growth of this species particularly fit it for a desert habitat. It is an annual, producing an abundance of seeds which have their special methods of dissemination by burrowing into the ground and thus enable it to persist where less aggressive plants fail. When mature the spike, together with the short, sharp-pointed peduncle, drops off entire. This callus-like peduncle is thickly beset with short, stiff, retrosely arranged hairs, which, together with the awns of the spikelets and the recurved awn-like prolongation of the rachis, assist in the burial of the seed or its adhesion to anything with which it may come in contact.

This is doubtless one of the least valuable of the abundant species of this genus. Usually no grazing is done upon it during the time that it is ripening, and, where very

Explanation of Plate 77.—A. A very large plant of *Bouteloua aristidoides* from a favorable depression in desert mesas east of Tucson, Arizona. B. A nearly pure stand of the same upon the desert mesas north of the Santa Rita Mountains of Arizona, in a very favorable season.

plentiful, sheep are removed from it on account of the injury inflicted by the sharp-pointed spikes which work into their feet and disable them. When young, especially before blooming, it is readily grazed by stock, but even then the plants too easily pull up by the roots, the feed therefore being mixed with sand to an annoying extent. In late autumn, after the spikes have fallen off, the grass apparently affords but little nutriment and stock avoid it as much as possible. Associated with it in this country is usually found *Aristida humboldtiana*, which has similar characteristics and which adds to the injurious effects.

HERBARIUM SPECIMENS.

ARIZONA: *Mearns* 1122, San Pedro River near Mexican Boundary; 924, south of Bisbee. *Rothrock* 701, Riley's Well (near Tucson). *Smart* 429, Camp McDowell. *Rusby* 891, Beaver Creek. *Toumey* 802 and in Seymour's Grasses 84, Tucson. *Griffiths* 1523, 3343, Tucson; 1922, Cochise; 1818, Mescal; 1928, Pearce; 3379 and 3418, Santa Rita Forest Reserve. *Jones* 6065, Canaan Ranch. *Wilcox*, Fort Huachuca. *Blumer* 1705, Paradise. *Hitchcock* 3490, 3507, 3510, Tucson; 3665, Patagonia.

CALIFORNIA: *Orcutt*, San Diego.

NEW MEXICO: *Mulford* 1000, Florida Mountains. *Metcalfe* 702, Silver City. *Cockerell* 18, Jarilla Junction. *Plank* 43, Socorro. *Wooton* 1053, Las Cruces; 411, Donna Ana County. *Mearns* 2340, Dog Mountains; 924, south of Bisbee. *Hitchcock* 3756, Deming.

TEXAS: *Cockerell* 14, Fort Bliss. *Plank* 8, Llano; 63, El Paso. *Nealley*, Laredo.

MEXICO: *Palmer* 1353, 1354, Soledad, Chihuahua; 162, Guaymas; 1650, Lodiego; 1547, Culiacan; 7, Yaqui River; 177 and 714a, Durango; 859, Carmen Island; 697, Alamos. *Pittier* 474, Tlahualilo, Durango. *Brandegee*, Culiacan; 4, San José del Cabo, Lower California. *Schaffner*, San Luis Potosí. *Pringle* 477, Chihuahua; 4592, Tequila. *Parry & Palmer* 941, San Luis Potosí. *Hitchcock* 3638, Nogales; 3594 and 3533, Hermosillo; 3549, Guaymas; 3527 and 3519, Llano. *Rose* 2490, San Juan Capistrano. *Nelson* 6329, Casas Grandes, Chihuahua.

SOUTH AMERICA: *Stuckert* 10624, 12791, 13764, and 20114, Argentina; Kneucker Gram. Exsic. 448; *Kurtz* Herb. Argent. 12670.

20. Bouteloua pringlei Scribn.

Bouteloua pringlei Scribn. U. S. Dept. Agr. Div. Agrost. Circ. **30**: 4. 1901. Type, *Pringle* 8374, collected in the mountains above Iguala, Guerrero, Mexico, October 24, 1900, in the National Herbarium.

DESCRIPTION.

An erect, cespitose perennial, a meter high, resembling *B. curtipendula* in general appearance and habit; culms erect, simple; nodes and internodes smooth, but sheaths densely papillose-hairy upward, nearly smooth below, rather loose, with a small, densely hairy ligular region; blades long, flat, 5 to 7 mm. wide, more sparingly papillose-hairy; inflorescence racemose, the lower spikes showing a slight tendency to become compound, about 30 cm. long, the spikes arranged bilaterally but so curved or twisted, especially above, as to appear unilateral; spikes variable in size, small above and passing gradually into larger ones below, and finally by indistinct gradations into spike-bearing branches in the lower portion of the incipient panicle; spikelets 4 to 5 mm. long, not pectinate, consisting of a single floret and a rudiment represented by a very short prolongation of the rachilla; first glume nearly 3 mm. long, with hispid keel, the second densely hairy, nearly 4 mm. long, lanceolate, acuminate; lemma ovate, long ciliate hairy on the edges and terminating in three short, equal, hispid awns, about 4 mm. long; palet oblong, terminating in two short, hispid awns; rudiment very short, often difficult to distinguish; caryopsis oblong, 2 mm. long, 0.3

to 0.5 mm. wide, rounded on the back, the scutellum rounded at the apex and covering two-thirds to three-fourths of the ventral surface. (FIGURE 50.)

The only specimens of this species which have been seen are those of the type collection. The species is very closely related to *B. curtipendula*, but is easily distinguished by the felty-pubescent sheaths and the character of the inflorescence.

21. Bouteloua chondrosioides (H. B. K.) Griseb.

Dinebra chondrosioides H. B. K. Nov. Gen. & Sp. **1**: 173. *pl. 53.* 1816. The figures and description and a specimen in the Willdenow Herbarium, collected by Humboldt, show conclusively that this is a young plant of what we have long known in this country as *B. havardii.* There is another specimen in the Trinius Herbarium from Humboldt, determined by Kunth in 1836. The figures cited above are faulty in that they do not show the glumes as hairy as they are.

Bouteloua ovata Lag. Gen. & Sp. Nov. 5. 1816. Lagasca's description, "culmo subpentastachyo: spicis ovatis: glumis extus pubescentibus," applies very well to a young specimen of *B. havardii* such as the type of *Dinebra chondrosioides.* This, together with the fact that some of the earlier botanists have suggested that the two names apply to the same species, leads me to this disposition.

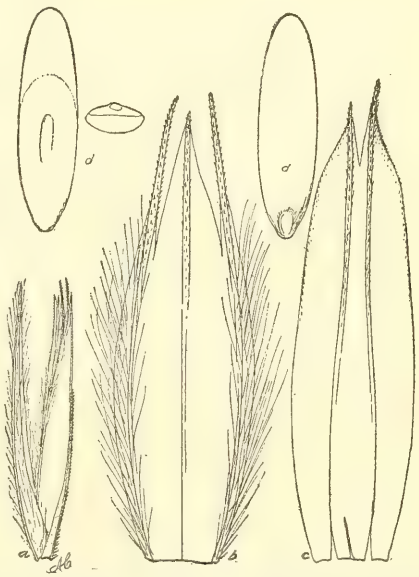


FIG. 50.—*Bouteloua pringlei.* *a*, Spikelet; *b*, *c*, lemma and palet with rudiment attached; *d*, two views and cross section of caryopsis. *a*, Scale 7.5; *b–d*, scale 15. From type specimen.

Atheropogon chondrosioides Roem. & Schult. Syst. Veg. **2**: 416. 1817. Based upon *Dinebra chondrosioides* H. B. K. See also Spreng. Syst. Veg. **1**: 293. 1825.

Actinochloa ovata Roem. & Schult. Syst. Veg. **2**: 420. 1817. Based on *Bouteloua ovata* Lag.

Eutriana cristata Trin. Gram. Unifl. 241. 1824. Based upon *Atheropogon chondrosioides* Roem. & Schult.

Chondrosium humboldtianum Kunth, Rév. Gram. **1**: 93. 1829. Based upon *Dinebra chondrosioides* H. B. K. See also Fourn. Mex. Pl. **2**: 136. 1881, where this species is also correctly interpreted. Fournier cites *Virlet* 1412. This number in the herbarium of the Muséum of Paris is exactly comparable with my no. 6732, which is a young specimen of *Bouteloua havardii.* *Schaffner* 133, cited by Fournier, in Grisebach's herbarium, is likewise an immature plant of *B. havardii.*

Bouteloua chondrosioides Griseb. in Fourn. Mex. Pl. **2**: 136. 1881. This name, presumably based on *Dinebra chondrosioides*, is mentioned as a synonym under *Chondrosium humboldtianum.* Watson [a] gives this combination with Bentham as the author.

Bouteloua havardii Vasey in Wats. Proc. Amer. Acad. **18**: 179. 1883. Republished in Bull. Torrey Club **11**: 6. 1884. The specimen cited in the latter place is *Havard* in 1881, from Limpio Mountains of western Texas. The type specimen in the National Herbarium is numbered 53. See also U. S. Dept. Agr. Div. Bot. Bull. **12**[1]: *pl. 38.* 1890; U. S. Dept. Agr. Div. Agrost. Bull. **7**: 216. *f. 198.* 1897.

[a] Proc. Amer. Acad. **18**: 179. 1883.

DESCRIPTION.

A stout, erect, mostly cespitose perennial, with leafy base and comparatively naked culms, striate, loose sheaths, small, sparingly ciliate, pubescent ligules, and slender, flat, rather rigid blades, slightly pubescent beneath; panicle racemose, about 4 cm. long; spikes 4 to 6, densely woolly, 1 to 1.5 cm. long, short-pedicellate from the sharp angles of a zigzag rachis; spikelets consisting of one lower perfect floret and a rudiment, more or less pectinate before anthesis, but this arrangement lost with the development of the long, rigid awns; first glume about 3 mm. long, the second about 4 mm. long, both

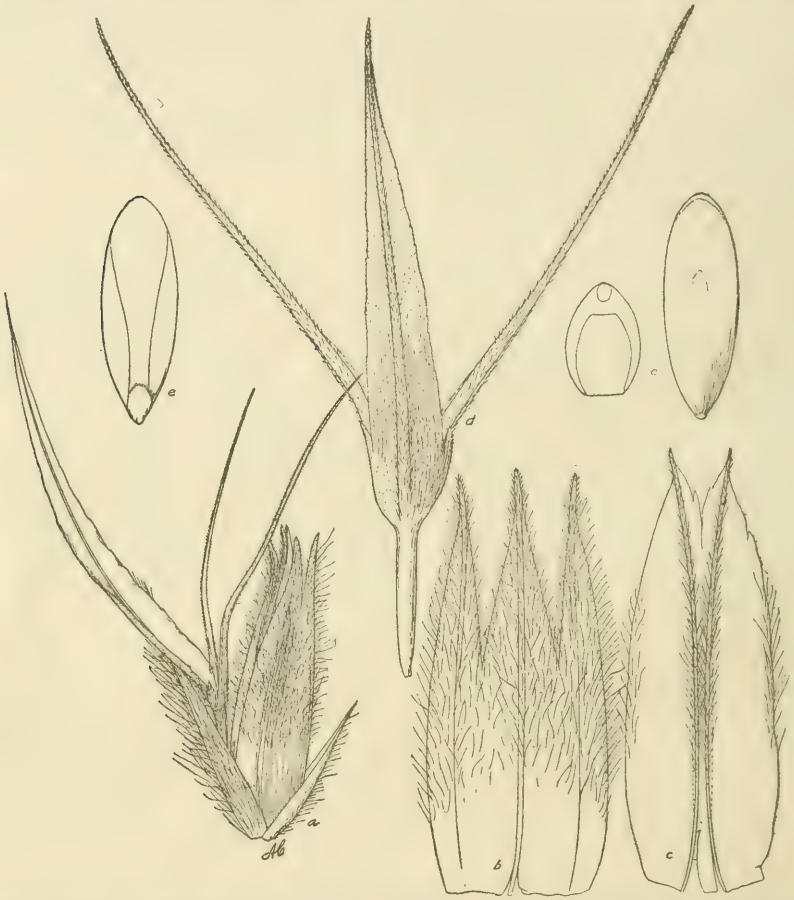


FIG. 51.—*Bouteloua chondrosioides*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, rudimentary second floret; *e*, two views and cross section of caryopsis. *a*, Scale 7.5; *b–e*, scale 10. *a–d*, From type specimen of *B. havardii*: *e*, from *Griffiths* 7266.

densely woolly, acuminate, indistinctly keeled; lemma, about 6 mm. long, densely woolly, terminating in three equal awns; palet about the same length, woolly on the edges, the two nerves terminating in short awns; rudiment consisting of 3 hispid, nearly equal awns, about 7 mm. long, upon a short, naked stipe 1 to 1.5 mm. long, the central awn and often the lateral with glume-like wings; caryopsis oval, about 2.5 mm. long, 0.9 mm. wide, the scutellum covering nearly the whole ventral surface and curving over the sides onto the dorsal surface. (FIGURE 51.)

This species attains its maximum development in the plateau region of Mexico, where there are large areas covered with it to the exclusion of nearly all else. It also

forms a large part of the forage upon limited areas in the foothills in southern Arizona. It is easily recognized by its woolly spikes, but may be confused with *B. eludens.*

There is probably a greater difference between young and mature specimens in this species than in any other of the group. If Kunth's figures are compared with the figures in this text the difference will be easily appreciated. However, my specimens show conclusively that the awns and rudiment develop greatly after anthesis. It is certain that Kunth had immature plants. An examination of the specimens which I am distributing under this name furnish ample proof of the position which is taken here. The plant which Kunth had is also abnormally small. However, this species, in exactly the form described by Kunth, has been seen in abundance in closely grazed areas upon the highlands of Mexico. Upon the highlands of Zacatecas, San Luis Potosí, Aguascalientes, and portions of Jalisco and Oaxaca it is common to find the grass, closely grazed and trampled, forming some semblance of a turf. Under these conditions there is a difference between this form and the common forms of the more arid and stony regions which is comparable to that between the *B. gracilis* of the prairies of the Dakotas and that of the mountains of Arizona. When closely grazed and trampled the culms are short. It was a young plant grown under such conditions that Kunth figured. Conzatti's no. 156 from Oaxaca is a perfect match for the figures mentioned. Portions of Toumey's no. 138, Pringle, "Sandy Plains near Mexican Boundary, Arizona, Aug. 8, 1884," portions of Havard's no. 1, Limpio, Western Texas, July–Sept., 1883, are like the type so far as some of the spikes are concerned. I consider *Wilkinson* 53, *Pringle* 410, *Lemmon* 4635, and 371, *Griffiths & Thornber* 2, *Nealley* 414a and 166, typical of *B. havardii* which is the mature stage of the plant. Many of the spikes of *Pringle* 410 perfectly match the Humboldt specimen.

HERBARIUM SPECIMENS.

ARIZONA: *Hitchcock* 3702, Patagonia. *Griffiths* 1829, Mescal; 3440, Santa Rita Forest Reserve. *Wilcox*, Fort Huachuca. *Griffiths & Thornber* 2, Santa Rita Forest Reserve. *Lemmon*, 371 "S. E. Arizona"; 4635, locality unknown. *Toumey* 800, 138, Tucson. *Parish* 262, Tucson. *Pringle*, near Mexican Boundary.

TEXAS: *Nealley* 166, Presidio County. *Havard* 1, Mesquit Canyon, western Texas; 53, Limpio Mountains.

MEXICO: *Pringle* 410, Chihuahua. *Wilkinson*, Santa Eulalia Plains, Chihuahua. *Mearns* 1897 near Mexican Boundary Monument No. 82. *Palmer* 546, Durango. *Conzatti* 156, Oaxaca. *Rose* 2532, Huejuquilla, Jalisco; 2782, Plateado, Zacatecas.

22. Bouteloua eludens sp. nov.

DESCRIPTION.

A tall, erect, cespitose perennial, 20 to 50 cm. high, having a general resemblance in its more diminutive forms to *B. chondrosioides* and in some of its taller, more robust forms to hairy-spiked forms of *B. curtipendula;* culms erect, unbranched; blades rather abundant, narrow, and most radical, flat, with serrate edges, often 15 cm. long and about 1 to 1.5 mm. wide; ligule reduced to a fringe of short, white hairs; inflorescence racemose, 6 to 8 cm. long; spikes 10 to 20, bilaterally arranged on a zigzag axis, but so twisted on the peduncles as to appear unilateral, triangular, about 1 cm. long; spikelets about 5, consisting of a lower staminate, pistillate, or perfect floret, a middle staminate, pistillate, or perfect or even rudimentary floret, and an upper rudiment varying from a simple prolongation of the rachilla, to a trifid-awned structure with two scales or to a well-developed lemma, or sometimes entirely absent; glumes narrow, densely pubescent, the first acuminate, 5 to 6 mm. long, the second very short-awned and about 1 mm. longer; lemma 6 to 7 mm. long, pubescent, trifid, with 3 winged, short awns; lemma of second floret pubescent, about 10 mm. long, with 3 hairy-hispid awns, the central about 1 mm. longer than the lateral and with projec-

tions of the lemma between and outside of the awns; palet of lower floret pubescent above, acuminate, that of the second floret with 2 short awns, both about 6 mm. long; third floret a simple, undivided awn, a rudimentary lemma consisting of 3 long, pubescent, scabrous awns, or a well-developed lemma resembling that of the second floret, but smaller; caryopsis obovate, about 5 mm. long and 1.5 mm. wide, the scutellum covering nearly the entire ventral surface, or only about one-half of it. (PLATES 78, 79, 80, A.)

This species occurs on familiar collecting ground where the most active botanical collectors have worked for years and where the writer collected for about three years before finding it. No specimens of it have been found in any of the herbaria examined. There are literally scores of acres where it forms one-half to three-fourths of the entire vegetation and consequently is, locally, an important economic species.

I first collected the species in the State of Sonora about a mile south of Nogales, Arizona, and subsequently in several situations in northern Sonora and southern Arizona. I have seen or collected it on the slopes of the Cananea Mountains, in the Celero Mountains, where it is most abundant, and in the Santa Rita and Santa Catalina Mountains. It is more likely to occur upon southern exposures, especially in the Santa Rita and the Santa Catalina Mountains, where it may be neglected for the more common and well-known *Bouteloua chondrosioides*. In some situations southeast of Nogales, however, where it grows most luxuriantly, it might be mistaken for a hairy-spiked form of *B. curtipendula*. This in itself indicates a striking variation in the general aspect of the species. As indicated in the illustrations, the floral structure is fully as variable.

The type is *Griffiths* 7269, collected on southern exposures upon the northern slope of the Santa Rita Mountains, Arizona, September 17, 1904.

23. Bouteloua megapotamica (Spreng.) Kuntze.

Pappophorum megapotamicum Spreng. Syst. Veg. **4**: Cur. Post. 34. 1827. The type was collected by Sello "Rio Grande," Brazil.

Eutriana multiseta Nees, Agrost. Bras. 413. 1829. This was described from a specimen in the Berlin Herbarium collected by Sello at Montevideo. This specimen and a duplicate in the Trinius Herbarium have been examined. See also Kunth, Rév. Gram. **2**: 449. *pl. 138*. 1829.

Pappophorum eutrianoides Trin.; Nees, Agrost. Bras. 414. 1829. Mentioned as a synonym under *Eutriana multiseta*.

Bouteloua multiseta Griseb. Abh. Ges. Wiss. Göttingen **18**: 303. 1879 (Symb. Fl. Argent.). Based upon *Eutriana multiseta* Nees.

Bouteloua megapotamica Kuntze, Rev. Gen. Pl. **3**[2]: 341. 1893. Based upon *Pappophorum megapotamicum* Spreng.

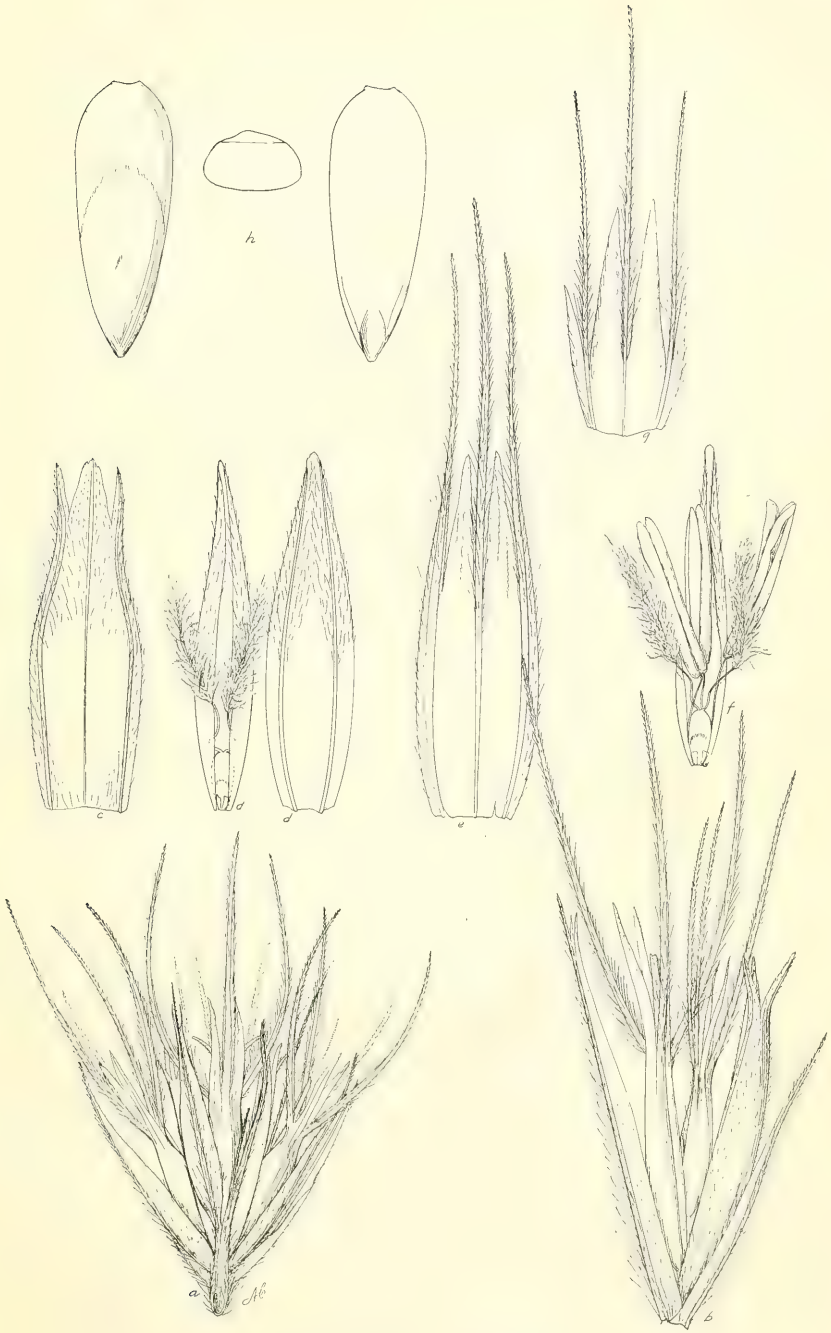
DESCRIPTION.

A cespitose, erect or ascending, strongly stoloniferous perennial; culms about 20 cm. high, erect or geniculate at base, not branched; sheaths close, striate, smooth; blades rather rigid, abundant below, and often 10 cm. long, but short above, inconspicuously hairy especially on the lower surface, the edges hispid; ligule consisting of

EXPLANATION OF PLATE 78.—*a*, Spike of *Bouteloua eludens;* *b*, spikelet; *c*, lemma of first floret; *d*, two views of palet of same, one showing pistillate flower; *e* and *f*, lemma and palet with perfect flower of second floret; *g*, rudimentary lemma of third floret; *h*, two views and cross section of caryopsis. *a–f*, Scale 5; *g*, scale 7.5; *h*, scale 15. From type specimen.

EXPLANATION OF PLATE 79.—From type specimen of *Bouteloua eludens* and photograph taken in Santa Catalina Mountains, Arizona. (5 x 7 No. 3076 Farm Management, U. S. Dept. Agr.)

EXPLANATION OF PLATE 80.—View showing the strong tufty character of *Bouteloua eludens*, on southern exposures in Sabinio Canyon, Santa Catalina Mountains, Arizona, in the latter part of September. B. *Bouteloua curtipendula* from the vicinity of San Antonio, Texas, where this grass is of minor importance, being usually crowded by ranker species. Farther north, in the vicinity of San Angelo, it grows more nearly pure.



BOUTELOUA ELUDENS GRIFFITHS.



BOUTELOUA ELUDENS GRIFFITHS.



A. BOUTELOUA ELUDENS GRIFFITHS.



B. BOUTELOUA TEXANA S. WATS.

a ring of numerous long, white hairs; spikelets about 5 to 10, not pectinate, consisting of 1 floret and a rudiment; glumes hispid and hairy-tufted at base, awned, the first 6 mm., the second 10 mm. long, the latter having an abrupt constriction above, the apex continued into two acuminate, awn-like teeth, 0.5 to 1 mm. long, on each side of the central awn; lemma 11 to 12 mm. long including awns, smooth, shining, and bone-like on the back, with 3 hispid, spreading awns about 5 mm. long, the lateral awns nearly equal to the central; palet deeply sulcate on the back and involute on the

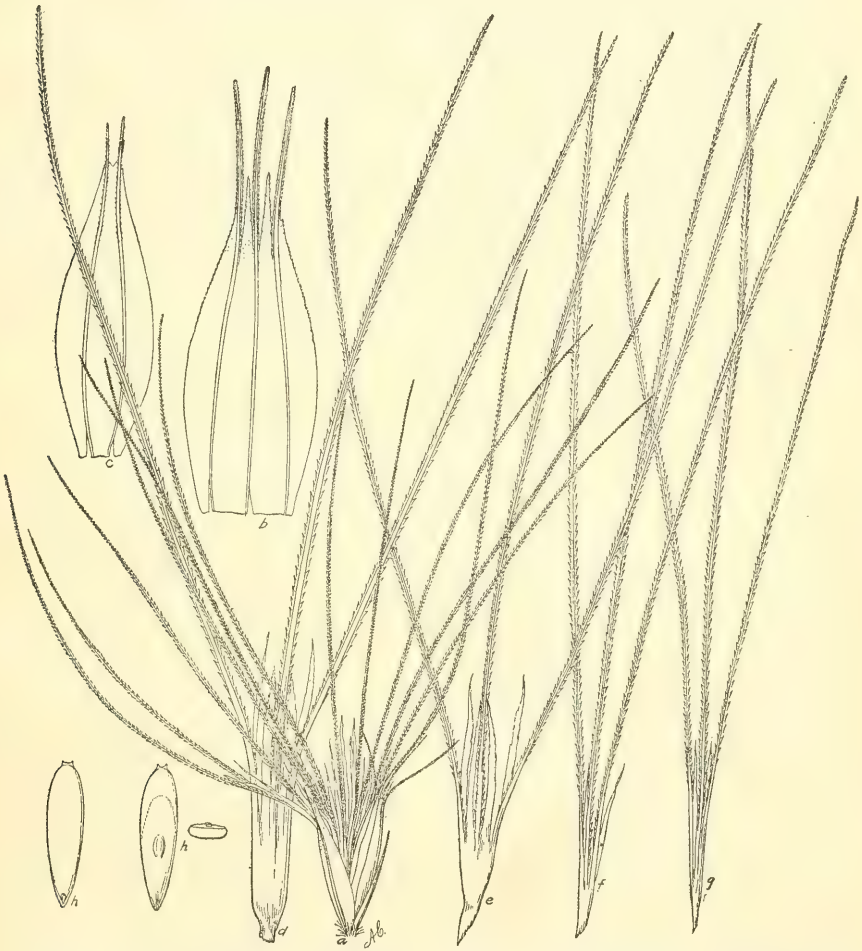


FIG. 52.—*Boutelova megapotamica*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d–g*, rudimentary second, third, fourth, and fifth florets; *h*, two views and cross section of caryopsis. *a*, Scale 2.5; *b–h*, scale 5. From *Arechavaleta*, Montevideo.

edges, 2-awned, 8 to 9 mm. long; rudiment consisting of 2 or 3 aborted florets appearing like a cluster of 9 to 12 hispid awns of various degrees of rigidity, interspersed with delicate narrow scales a fourth as long or less; caryopsis cylindrical-obovate, 2 to 2.5 mm. long, the scutellum covering about two-thirds of the ventral surface. (FIGURE 52.)

Stuckert's no. 27, Kneucker's Gram. Exs. 376, and *Arechavaleta* from Montevideo, are typical. The latter shows the stoloniferous character beautifully.

24. Bouteloua texana S. Wats.

Bouteloua (*Polyodon*) *texana* S. Wats. Proc. Amer. Acad. **18**: 196. 1883. The first specimen cited, *Berlandier* 1535, which I accept as the type, I have been unable to find in the Gray Herbarium. Duplicates of *Hall* 771 and *Wright* 752, which are cited by Watson, are in the National Herbarium. See also U. S. Dept. Agr. Div. Agrost. Bull. **7**: 215. *f. 197.* 1898.

Polyodon texanus Nash in Small, Fl. Southeast. U. S. 138. 1903.



FIG. 53.—*Bouteloua texana*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, *e*, rudimentary lemma and palet of second floret; *f*, rudimentary third floret; *g*, two views and cross section of caryopsis. *a*, Scale 7.5; *b–g*, scale 10. From *Griffiths* 6370.

DESCRIPTION.

An erect, cespitose perennial, 20 to 30 cm. high, usually growing in scattering bunches among other grasses, seldom occupying areas exclusively; culms simple, erect; sheaths rather close, smooth, striate, with a small ligule bearing a few scattered hairs or a ciliate fringe; blades narrow, involute, about 10 cm. long, sparingly pubescent with long, papillose hairs on the edges and especially on the upper surface, the hairs less conspicuous below; inflorescence racemose, 4 to 5 cm. long; spikes 6 to 8, about 1 cm. long, on short, pubescent peduncles 1 mm. long, easily separable and dropping off entire; spikelets not pectinate, crowded, consisting of a lower fertile floret and 2 upper rudiments, or often the entire spikelet rudimentary; glumes unequal, lanceolate, acuminate, hairy, the first 3 to 4 mm., the second about 6 mm. long, short-awned; lemma about 6 mm. long over all, sparingly hairy on the nerves, bearing 3 equal, hispid awns; palet 4 to 5 mm. long; ovate, acuminate or with 2 very short awns; lower rudiment of 3 equal, hispid awns about 7 mm. long, united at their bases by rudimentary glumes, and having a rudimentary, cleft palet 2 to 3 mm. long, the upper rudiment of the same nature but smaller in all its parts and usually with no palet; caryopsis about 2 mm. long, 0.6 mm. wide, flat on the dorsal surface, the scutellum covering about seven-eighths of the entire ventral surface. (PLATE 80, B, facing p. 402. FIGURE 53.)

On account of the abundance of root leaves and its bunched nature, this is a rather good forage grass. It does not appear to be able, however, to compete successfully enough with other species to make it of any great importance. The species is common on the southern plains and in the Rio Grande region and is rather important in the vicinity of San Angelo, Texas.

Pringle's no. 9018, distributed as *B. bromoides* Lag., *Nealley* 17, *Heller* 1485, *Tracy* 8105, and *Reverchon* 1135 are representative of the species.

HERBARIUM SPECIMENS.

TEXAS: *Drummond* 374. *Ball* 1110, Chillicothe. *Wright* 75, Dallas. *Letterman*, Dallas, August, 1882. *Hall* 771, Houston. *Nealley* in 1889; 17, Houston. *Reverchon* 1155, 4215 and 522, Dallas. *Heller* 1485, Nueces County. *Piper*, Kingsville. *Warburton*, Terrell. *Tracy* 8861 and 8889, Corpus Christi; 8878, Kingsville; 8105, Abilene. *Havard*, Eagle Pass. *Jermy*, San Antonio. *Smith*, Kerrville and San Diego. *Bray* 329, Llano; 296, Fredericksburg. *Bush* 244, Houston; 176, Columbia. *Plank* 28, Burnet.

MEXICO: *Pringle* 9018, Diaz, Coahuila.

25. Bouteloua lophostachya Griseb.

Bouteloua lophostachya Griseb. Abh. Ges. Wiss. Göttingen **19**: 302. 1879 (Symb. Fl. Argent.). The type (Hieronymus's no. 971 from Argentina) in the Grisebach Herbarium, has been examined.

Bouteloua nana Griseb. Abh. Ges. Wiss. Göttingen **19**: 303. 1879 (Symb. Fl. Argent.). The type in the Grisebach Herbarium (Hieronymus's no. 721, Guazapampa, Argentina) is unquestionably a depauperate form of *B. lophostachya*. *Bouteloua nana* is also a younger plant but the panicle and the floral and habit characteristics are in every respect identical with those of *Hieronymous* 971.

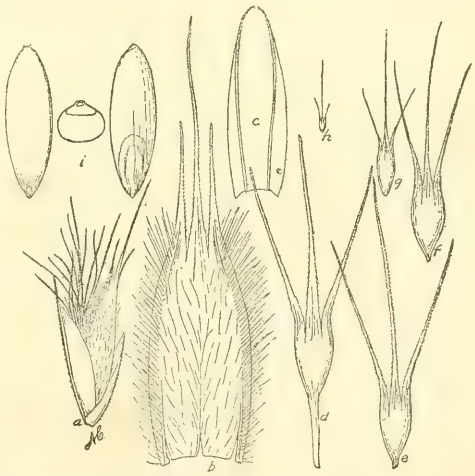


FIG. 54.—*Bouteloua lophostachya*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d–h*, rudimentary second, third, fourth, fifth, and sixth florets; *i*, two views and cross section of caryopsis. *a*, Scale 10; *b–i*, scale 15. From *Kurtz* 12687.

DESCRIPTION.

A cespitose, harsh, rigid perennial, with freely branching stems and short, stout rootstalks; sheaths striate, short but completely covering the lower internodes; blades rigid, divaricate, harsh, keeled, sharply cuspidate-pointed, 2 to 4 cm. long, abundant below but few above; panicle with 15 to 30 spikes scattered along the main axis, 5 to 10 cm. long, occasionally 2 or 3 spikes together; spikes loosely and indistinctly pectinate, 1 to 3 cm. long; spikelets 15 to 20, consisting of a lower perfect floret, with 2 to 4 rudiments above; glumes very slightly scabrous-keeled and short-awned, the first slightly shorter than the second, about 2 mm. long; lemma pubescent, 3 to 3.5 mm. long, 3-awned, the central awn 2 or more times longer than the lateral; palet obovate, 2-nerved, awnless, about 1.5 mm. long; rudiment consisting of 4 or even 5 well-developed 3-awned scales resembling the lemma but diminishing

in size upward, the last sometimes faced by a small 1-awned scale, the whole so congested as to appear like a bunch of awns, and borne upon a short, naked stipe about 1 mm. long; caryopsis 1.25 mm. long, ovate, flattened on the back, the very small scutellum covering only one-fourth or one-fifth of the ventral surface. (FIGURE 54.)

In general appearance, especially as to inflorescence this species resembles Leptochloa, but the floral characters are those of Bouteloua. The basal portion of the plant resembles that of *Muhlenbergia pungens* Thurb.

HERBARIUM SPECIMENS.

SOUTH AMERICA: *Stuckert* 10277*a*, in Herb. Argent.; 694, in Kneucker's Gram. Exs. from Argentina. *Elliott* 510, Chile. *Benivati* 12687 in Kurtz, Herb. Argent.

26. Bouteloua acuminata (Fourn.).

Atheropogon acuminatus Fourn. Mex. Pl. 2: 139. 1881. The specimens cited, *Liebmann* 583, from Mirador, and *Liebmann* 584, from Potrero de Consoquitla, Mexico, have not been examined. My knowledge of the species is based upon Palmer's no. 1655, concerning the identity of which there appears to be no doubt.

DESCRIPTION.

A stout, erect, smooth, cespitose perennial, resembling *B. curtipendula* in habit and general appearance; culms erect, comparatively stout, about 50 cm. high, leafy to the top, mostly unbranched; sheaths striate, close; blades broad, flat, often 5 mm. wide and 25 cm. long, striate, smooth with serrate edge, and conspicuous, long, dusky, papillose hairs on the upper surface at the base, the ligular membrane with a few scattered hairs of the same nature; panicle racemose, often 25 cm. long; spikes numerous, 30 to 60, distinctly bilateral but the peduncles so curved as to appear unilateral toward maturity; spikelets 6 to 15, loosely and indistinctly or not at all pectinate, consisting of 1 floret and a rudiment; glumes hispid, keeled, the first acuminate, about 2 mm. long, the second short-awned, about 3 mm. long; lemma minutely pubescent, shortly 3-aristate, the central awn 0.5 mm. or less longer than the lateral, about 4 mm. long; palet, acuminate, smooth, about 2.5 mm. long; rudiment reduced to a single, hispid, delicate awn, about 1.5 mm. long; caryopsis not seen. (FIGURE 55.)

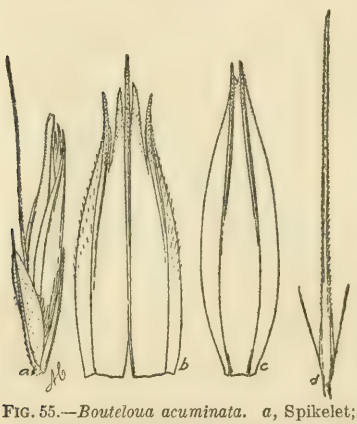


FIG. 55.—*Bouteloua acuminata*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, rudiment. *a*, Scale 7.5; *b–d*, scale 10. From *Palmer* 1655.

In general habit this very closely resembles *B. curtipendula*, but the spikes are very different, although exactly the same in arrangement. They are smaller and apparently more numerous. Indeed, one might describe the species as *B. curtipendula* with small delicate spikes of rather loosely arranged spikelets, only a fourth the size of those of that well-known species.

Palmer's 1655, cited above, of which there are two sheets in the National Herbarium, is from Lodiego, Sonora, Mexico, collected October 9 to 15, 1891. It is said to grow in large bunches on the mountain sides.

27. Bouteloua vaneedeni Pilger.

Bouteloua vaneedeni Pilger in Urban, Symb. Antill. **6**: 2. 1909; see also Boldingh, Recueil Trav. Bot. Néerland. **6**: 7. 1909.

DESCRIPTION.

An erect, cespitose perennial, 30 to 40 cm. high; sheaths smooth, striate, close; blades narrow, involute, 6 to 10 cm. long, with a very small ligular ring of white hairs; inflorescence racemose, about 12 to 15 cm. long; spikes small, 4 to 5 mm. long, and only about 1 mm. wide, numerous, about 30; spikelets 2 to 4, in specimens before me only the distal one fully developed, the proximal ones 1-flowered, the distal one with a second floret in the form of a trifid rudiment, the lateral awns very short; glumes smooth, strongly nerved, the first 3 mm., the second 4 mm. long, scarcely awned; lemma smooth, 4 mm. long, bearing awns less than 1 mm. long; palet about the length of its lemma, bearing very short awns. (FIGURE 56.)

I am under obligations to both Doctors Pilger and Boldingh for specimens of this interesting species, collected by the latter (no. 3512 B) in the island of Anguilla, Leeward Islands.

In general aspect it appears to be very similar to *B. curtipendula*, while in other respects it even more closely resembles *B. uniflora*. In detail of the spike it bridges over three genera as here limited. The species is interesting in that there are one to three aborted, 1-flowered spikelets below and only one well-developed distal spikelet in which the second floret is the normal trifid awn, with, however, the lateral awns so short as to be scarcely visible. The type affords all the knowledge we have concerning this species and that specimen is immature. It is possible that mature material will necessitate a different disposition of the species.



FIG. 56.—*Bouteloua vaneedeni*. *a*, Spikelet; *b*, *c*, lemma and palet with rudiment attached. *a*, Scale 5; *b*, *c*, scale 7.5. From type specimen.

28. Bouteloua americana (L.) Scribn.

Aristida americana L. Amoen. Acad. **5**: 393. 1759; Syst. Nat. ed. 10. **2**: 879. 1759. This name has been misapplied by recent authors because of a misstatement by Munro[a] concerning its identity. Munro says that *A. americana* "is called *A. dispersa* by Trin.", and that "Kunth has misplaced the Linnæan synonym in *Eutriana juncifolia*." Munro, however, was in error, as is easily shown by an examination of the Linnæan plant (see under *Bouteloua americana* Scribn.); Swartz, Obs. Bot. 41. *pl. 2. f. 2.* 1791. The type, in the Linnæan Herbarium, is a specimen from Jamaica, collected by Patrick Browne.

Triathera americana Desv. Nouv. Bull. Soc. Philom. Paris **2**: 188. 1810. Based upon *Aristida americana* L. See also Roem. & Schult. Syst. Veg. **2**: 421. 1817.

Dineba americana Beauv. Ess. Agrost. 98, 160. *pl. 16. f. 1–3.* 1812. Based upon *Aristida americana* L.

Heterosteca americana Desv. Journ. de Bot. **1**: 68. 1813. Based upon *Aristida americana* Swartz.

Bouteloua litigiosa Lag. Gen. & Sp. Nov. 5. 1816. Based upon *Aristida americana* L.

Aristida furcata Poit.; Roem. & Schult. Syst. Veg. **2**: 711. 1817. A herbarium name published as a synonym of *Dineba americana* Beauv.

Eutriana juncea Trin. Gram. Unifl. 238. 1824. The specimen in the Trinius Herbarium, collected by Poiteau in Haiti, probably is the *Aristida americana* of Linnæus.

[a] Proc. Linn. Soc. Bot. **6**: 49. 1862.

I can not, however, from the insufficient fragment before me be certain about it. The leaves are shorter and rather more rigid than in that species.

Eutriana bromoides Trin. Gram. Unifl. 241. 1824, not Kunth 1833. It is more than probable that the species to which Trinius applied this name is *B. americana*, although the first synonym cited is *Atheropogon bromoides* Roem. & Schult. The other two synonyms are *Aristida americana* L. and *Bouteloua litigiosa* Lag., and the plant described is from the West Indies. Kunth[a] has in effect expressed the same view.

Bouteloua elatior Griseb. Fl. Brit. W. Ind. 537. 1864. A portion of the type, *Wullschlagel* 619 and 660, Antigua, in the Grisebach Herbarium, and a photograph are before me. It is typical of *Aristida americana* L.

Atheropogon americanus Fourn. Mex. Pl. **2**: 139. 1881. Based upon *Aristida americana* L.

Bouteloua triathera Benth. Journ. Linn. Soc, Bot. **19**: 104. 1881. Presumably based on *Triathera americana* Desv.

Bouteloua americana Scribn. Proc. Acad. Phila. **1891**: 306. 1891. Scribner bases this name on "*Aristida americana* Sw. Obs. 41. t. [2.] f. 2. (1791)", on the supposition that this was distinct from *A. americana* L., citing Munro's statement,[b] that the Linnæan *A. americana* was a true Aristida and the species named *Aristida dispersa* by Trinius. But, as has been shown, Linnæus's type specimen is a Bouteloua. Swartz does not give this as one of his own species, but gives a reference that leads to Linnæus's species. Swartz's illustration shows that he correctly interpreted the species. Hence Scribner's name is, in the last analysis, based on *Aristida americana* L.

DESCRIPTION.

A spreading, ascending, or erect, smooth annual; flowering culms mostly erect, freely branched, 20 to 30 cm. high; sheaths striate, smooth, short, close; blades narrow, involute, acuminate, bearing numerous papillose hairs on the edges toward the base, there merging into the very narrow ligular ring; spikes about 2 cm. long, very lax, 3 to 6 or 7; spikelets 5 to 7, about 3 mm. apart, not pectinate but loose, and lying at a narrow angle with the rachis; glumes pronouncedly keeled and strongly hispid, rather abruptly acuminate, the first about 3 mm., the second about 4 mm. long; lemma smooth, shining, and bone-like on the back, 3-awned, the lateral awns less than 1 mm. long, the central projecting about 2 mm. farther; palet 2-nerved, with 2 short awns, nearly as long as its lemma; rudiment consisting of a modified lemma of 3 awns about 9 mm. long, united into a hard small scale at the base and faced by a small 2-nerved rudimentary palet; caryopsis not seen. (FIGURE 57.)

The group comprising *Bouteloua americana* and the five species here following is a very difficult one and a great many names have been applied to the different species owing to a difference of opinion among authors as to generic and specific limitations and to the disregard of the principle of priority as well as to a misunderstanding or neglect of the earlier descriptions.

Bouteloua radicosa as interpreted here is fairly well marked off. It is a large, robust, almost woody based plant with wide, strongly papillose-hairy leaves. *Bouteloua repens* as here interpreted is not so common as has been supposed. It is easily recognized by its glaucous aspect and by its lack of papillose hairs. The species appears to be confined to the Pacific coast region of central and southern Mexico.

Bouteloua americana also is well characterized by its narrow spikes and annual habit.

It is *B. filiformis* and *B. heterostega* that present the greatest difficulties. They are very difficult to segregate, but that is simply another way of acknowledging that we do not know the species well enough.

[a] Enum. Pl. **1**: 281. 1833, under *E. bromoides*.

[b] See above under *Aristida americana* L.

In southern Arizona there is a plant which has heretofore passed for *B. bromoides*, so called. It is erect and has comparatively delicate stems and leaves. In southern Texas, where the soil is more fertile, precipitation more abundant, and shade of shrubbery a more important factor, it has a lighter green color and the culms are more inclined to become geniculate and often are decidedly so. In portions of the Mexican highland, where I judge the conditions are similar to those of Texas, upon the ocean slopes and apparently in portions of South and Central America the characteristics of the Texas form are accentuated and the culms are decidedly geniculate and much branched. In the West Indian islands the plant becomes still more modified into an exceedingly variable form which is often depauperate, prostrate, or even slightly stoloniferous. In the entire series I have as yet found no constant floral distinctions except that the West Indian plants often have greatly reduced spikes and prominently modified spikelets, which, however, always have typical ones mixed with them.

As stated above the Arizona-Texas plant has in the past been referred to *B. bromoides*. It extends in a typical form throughout the Mexican highland at least as far as the Isthmus of Tehuantepec. The geniculate Mexican form received the specific name *filiformis* from Fournier and the West Indian plant was called *Heterosteca juncifolia* by Desvaux. For the present it seems wise to recognize Desvaux's species, although unfortunately his name can not be used, and to include under that of Fournier the two forms of the Mexican highland, one of which reaches Arizona and is somewhat modified in Texas. Should it appear wise in the future to separate these two forms the erect one so typical of southern Arizona and the highland of Mexico will have to receive a new name.

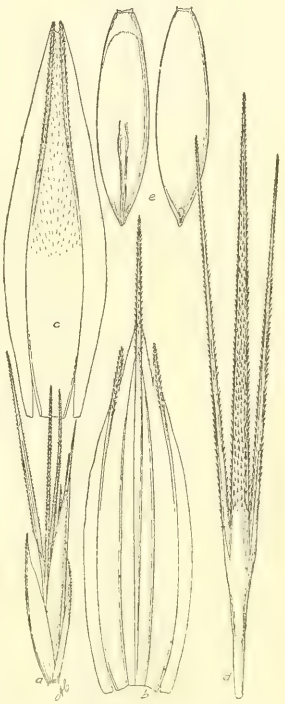


FIG. 57.—*Bouteloua americana*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, rudiment; *e*, two views of caryopsis. *a*, Scale 5; *b*–*e*, scale 10. From *Wright* 3816.

HERBARIUM SPECIMENS.

WEST INDIES: *Wright* 3816, Cuba. *Ricksecker* 78, St. Croix. *Broadway*, Tempe, St. George. *Hart* 559, Gordon Town, Jamaica. *Eggers* 687, St. Thomas; 5650, Scarborough, Tabago Island.

PANAMA: *Hitchcock* 8409.

There are two specimens, *Elliot* 138, Granada, and *Duss* 3160, Guadaloupe, which appear a little different in habit. They are mainly larger, ranker plants with even laxer spikes and with slightly shorter awns.[a]

29. Bouteloua repens (H. B. K.) Scribn. & Merr.

Dinebra repens H. B. K. Nov. Gen. & Sp. 1: 172. *pl. 52*. 1816. "Crescit ad littora Oceani Pacifici prope Acapulco." My interpretation of this is based upon the figures and descriptions.

? Bouteloua bromoides Lag. Gen. & Sp. Nov. 5. 1816. Lagasca says the plant is from Acapulco, which is the only reason for referring it to *B. repens*. He also says it is an annual, but this would be an easy mistake to make. A later specimen from

[a] Only the specimens in the National Herbarium are before me, as the last work on this group is done; consequently, citation of specimens can not be as ample as it otherwise might be.

Lagasca in the herbarium at Munich and one from the herbarium of the Botanical Garden at Madrid, bearing this name in Lagasca's hand, spikelets of which are before me, possibly should go with *B. filiformis*. It seems impossible to identify it. It has been commonly assumed that *Bouteloua bromoides* Lag. was the same species as that named *Dinebra bromoides* by Kunth, but Lagasca does not mention Kunth's species and his description does not apply to it.

? Actinochloa bromoides Roem. & Schult. Syst. Veg. **2**: 420. 1817. Based upon *Bouteloua bromoides* Lag.

Atheropogon repens Roem. & Schult. Syst. Veg. **2**: 416. 1817. Based upon *Dinebra repens*. See also Spreng. Syst. Veg. **1**: 293. 1825. Fournier [a] uses this name, but it is very certain that the specimens he cites under it do not belong here.



FIG. 58.—*Bouteloua repens*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, *e*, lemma and palet of second floret (rudiment attached to palet); *f*, portion of leaf blade. *a*, Scale 5; *b–e*, scale 7.5; *f*, scale 2.5. From *Hitchcock* 7080.

Bouteloua repens Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. **24**: 26. 1891. Based upon *Dinebra repens*. The former is the first correct combination which has been found, although the name was applied to a different species.

DESCRIPTION.

A smooth, glaucous-gray, leafy, stoloniferous, perennial, with erect or ascending and geniculate culms, 50 to 60 cm. high; sheaths striate, smooth, lax on branching culms, close on simple ones, the ligule bearing a few short, white hairs; blades broad, flat or the upper more commonly involute in drying, about 10 cm. long, and 4 mm. wide, conspicuously striate, hispid on the edges; panicle racemose, 10 cm. or more

[a] Mex. Pl. **2**: 140. 1881.

long, the basal portion often included in the sheath at anthesis; strikingly colored, with its purple glumes, green lemmas and cinnabar-colored anthers; spikes about 12, rather lax, flattened, 2.5 cm. long including the awns; spikelets 2-flowered with an additional rudiment consisting of a short, naked, awn-like projection beyond the palet of the second floret, and usually included in the fold of the palet; lower floret hermaphrodite, the second staminate or neuter; glumes sharply and hispidly keeled, acuminate but not awned, the second about 7 mm. in length, the first a trifle shorter; lemma of lower floret about 8 mm. long, with 3 short awns, the lateral awns 2 mm. shorter than the central; lemma of upper floret 12 mm. long, long-awned, the awns about the same relative length as in the lower floret, prominently scabrous; palet long, narrow, with 2 very short awns, plicate; caryopsis not seen. (FIGURE 58.)

No authentic material of this has been examined. Several of the older authors have listed it from Acapulco, but referred to it various forms of *B. filiformis*. It is distinguished from other species of the group by its large, stout, glaucous aspect and by its lack of papillose hairs on the edges of the leaves.[a]

Hitchcock's no. 7080, from Manzanillo, Mexico, is the only collection that I am able to refer to this species. It grows in large patches so close to the sea that the spray reaches it at high tide.

30. Bouteloua radicosa (Fourn.).

Dinebra bromoides H. B. K. Nov. Gen. & Sp. **1**: 172. *pl. 51.* 1816, not *Bouteloua bromoides* Lag. 1816. My interpretation of this is based upon the figures and description cited. There has been some confusion concerning this species, due mainly to the misinterpretation of this and also of *D. repens* H. B. K. See also Presl, Rel. Haenk. **1**: 292. 1830. The Haenke specimen in the herbarium of the German University of Prague shows that the species was correctly interpreted by Presl.

Atheropogon bromoides Roem. & Schult. Syst. Veg. **2**: 415. 1817. Based upon *Dinebra bromoides* H. B. K. See also Spreng. Syst. Veg. **1**: 293. 1825. Sprengel cites *Aristida americana* Swartz as a synonym, but that name does not belong to this species. It appears that Fournier[b] misinterpreted this. He credits the species to Roemer and Schultes and cites *Dinebra bromoides* H. B. K. as a synonym. According to my interpretation, however, the specimens which he cites belong to *A. filiformis*. *Galeotti* 5704 in the U. S. National Herbarium and the herbarium of the Botanical Garden of Brussels, a Karwinski specimen in the St. Petersburg Botanical Garden, and *Schaffner* 125 in the Willdenow Herbarium, all belong to *A. filiformis*. The same is true of *Botteri* 107 and *Liebmann* 575. A sheet of the last mentioned specimen in the National Herbarium is from the herbarium of the Muséum at Paris and is said to have been determined by Fournier.

Eutriana bromoides Kunth, Rév. Gram. **1**: 95. 1829, not Trinius, 1824. Based upon *Dinebra bromoides* H. B. K. See also Kunth, Enum. Pl. **1**: 281. 1833 and op. cit. **2**: 234. *pl. 17. f. 4.* 1835; also Steud. Syn. Pl. Glum. **1**: 216. 1854.[c]

Nestlera festucaeformis Willd.; Steud. Nom. Bot. ed. 2. **2**: 192. 1841. A herbarium name only, given as a synonym of *Eutriana bromoides*.

Heterostega festucaeformis Bonpl.; Fourn. Mex. Pl. **2**: 140. 1881. A herbarium name cited as a synonym of *Atheropogon bromoides*.

Atheropogon radicosus Fourn. Mex. Pl. **2**: 140. 1881. *Bourgeau* 450, from Mexico, is the type. This number in the herbaria of the St. Petersburg Botanical Garden, Muséum at Paris, and Botanical Garden of Brussels and in the U. S. National Herbarium has been examined. The specimen at Paris is the type.

[a] See discussion after *Bouteloua americana*.

[b] Mex. Pl. **2**: 140. 1881.

[c] For use of this date of publication see Rendle, Journ. Bot. **37**: 33. 1899.

DESCRIPTION.

A stout, erect, cespitose, long-lived perennial with stout rhizomatous base, usually in isolated bunches, but occasionally in continuous patches in the southern portion of its range; culms erect, stout, unbranched, 60 to 80 cm. high; sheaths close, strongly striate; blades abundant below and more sparing above, flat, variable in width, mostly 2 to 3 mm. wide, with regularly disposed papillose hairs on the edges; ligule a ciliate fringe of white hairs, about 1 mm. long; spikes loose, variable, often 3 cm. long by about 8 mm. wide or sometimes only 1.5 cm. long, and then resembling those of *Bouteloua filiformis;* spikelets 7 to 10 or sometimes even as much as 11 or 12 mm. long, consisting of 2 florets, the lower perfect, the upper either pistillate or perfect and producing mature seed more often than the lower one; glumes sharply acuminate, the first 4, the second 5 to 6 mm. long; lemma smooth, bone-like, 7 to 8 mm. long, 3-awned, the lateral awns about 1 mm. and the central 2 to 3 mm. long; palet inclosing the caryopsis, scarcely awned, but 1 mm. shorter than the lemma; floret of the same form and texture as that of the lower, 9 to 10 mm. long, with lateral awns 5 to 6 mm. and the central about 1 to 2 mm. longer; palet not differing materially from that of the lower floret; caryopsis about 4 to 5 mm. long, 0.75 to 1 mm. wide, flattened, the scutellum covering four-fifths of the ventral surface. (PLATE 81.)

As stated elsewhere this species grows in the upper foothills and mountains and reaches higher altitudes than the closely related *B. filiformis* with which it is commonly mixed. It differs from that species mainly in being a taller, coarser plant throughout. Its leaves are larger and wider, the culms are larger and stouter, the papillose hairs upon the edges of the leaves are more pronounced and obvious, and the spikes are longer. However, upon plants of *B. radicosa* may be found some spikes which might pass for *B. filiformis*, and plants of *B. filiformis* grown in exceptionally favorable localities have spikes as long as some forms of *B. radicosa*. It is only in consideration of an aggregation of characters that they can well be distinguished, yet they are in my mind perfectly worthy of being kept apart and are easily distinguishable in the field and usually upon the herbarium sheet as well. *Bouteloua radicosa* is found in rather high situations from Arizona and New Mexico to southern Mexico along the continental highland, and extends westward in important quantities especially into Jalisco and Guerrero.[a] As in *B. filiformis* there is a great variation in the spikelet. More commonly it is the second floret that is perfect instead of the first. *Tonduz* 13745 [b] is referred here doubtfully on account of the very small spikes.

HERBARIUM SPECIMENS.

ARIZONA: *Wilcox*, Fort Huachuca in 1894. *Jones* 562, Bowie. *Griffiths & Thornber* 220, Santa Rita Mountains. *MacDougal* 798, Dos Cabezas. *Nealley*, Rincon Mountains.

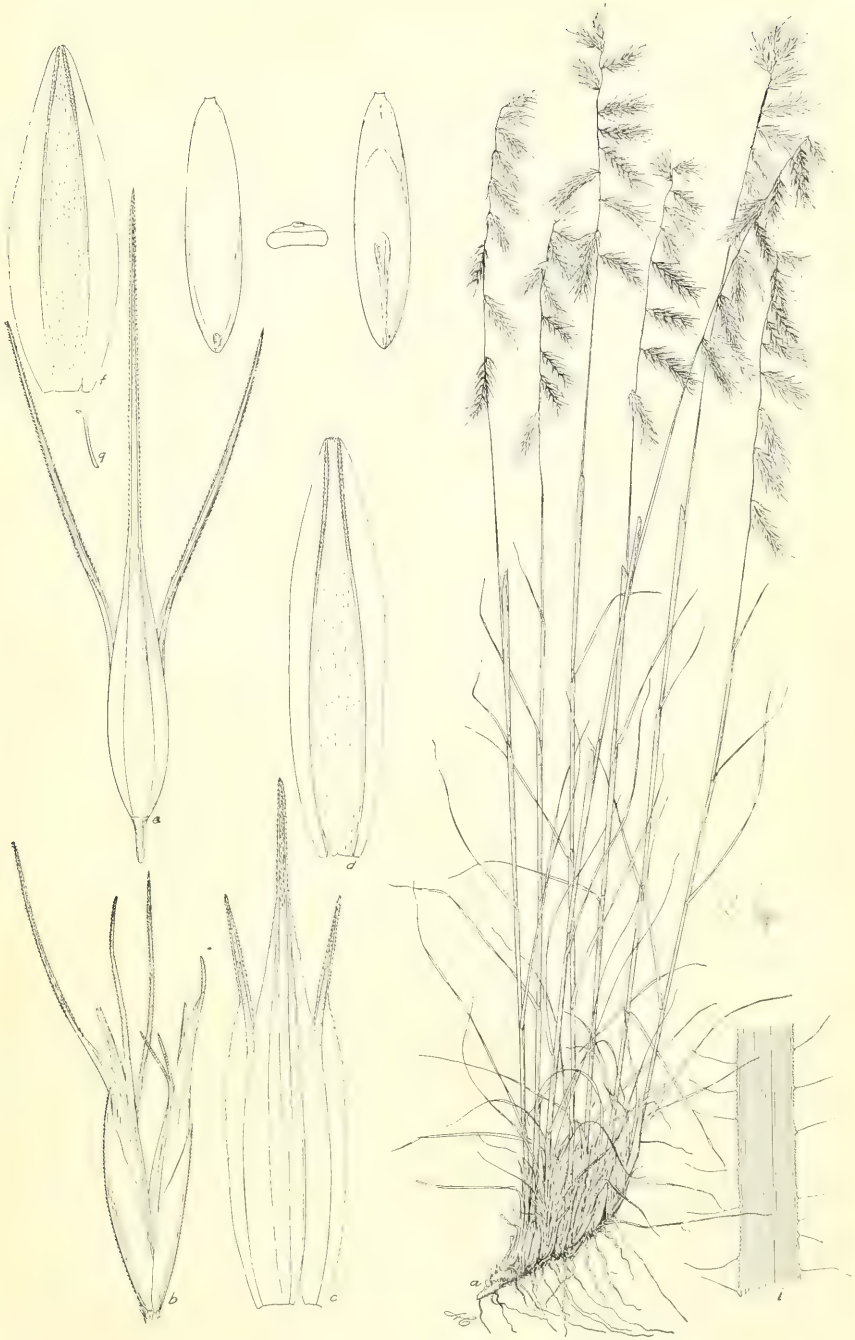
CALIFORNIA: *Orcutt* in 1884.

NEW MEXICO: *Wright* 2024. *Smith*, Mangas. *Rusby* 460, Burro Mountains.

MEXICO: *Mearns* 855, south of Bisbee. *Townsend & Baker* 226, Colonia Garcia. *Bourgeau* 450. *Pringle* 1436, Guerrero; 8567, Federal District. *Brandegee* 2 and 57, Cape region, Lower California. *Palmer* 1354, Coahuila, Nuevo León; 301 and 188, Rio Blanco; 115a, Chihuahua; 547, Durango. *Nelson* 2265, San Marcos, Guerrero; 1443 and 1258, valley of Oaxaca; 6258, Colonia Garcia, Chihuahua; 6305, Sierra Madres, Chihuahua. *Rose* 2672, Colotlan, Jalisco.

[a] See under *B. americana*. [b] Herb. Inst. fís.-geogr. Costa Rica.

EXPLANATION OF PLATE 81.—*a*, Habit sketch of *Bouteloua radicosa; b*, spikelet; *c, d*, lemma and palet of first floret; *e* and *f*, lemma and palet of second floret; *g*, prolongation of rachilla; *h*, two views and cross-section of caryopsis; *i*, portion of leaf blade. *a*, One-fourth natural size; *b–g*, scale 5; *h*, scale 7.5; *i*, scale 2.5. From *Griffiths* 7181 and photograph.



BOUTELOUA RADICOSA (FOURN.) GRIFFITHS.



A. BOUTELOUA FILIFORMIS (FOURN.) GRIFFITHS.



B. BOUTELOUA CURTIPENDULA (MICHX.) TORREY.



BOUTELOUA FILIFORMIS (FOURN.) GRIFFITHS.

31. Bouteloua filiformis (Fourn.).

Atheropogon filiformis Fourn. Mex. Pl. **2**: 140. 1881. According to Fournier's description and a specimen cited by Fournier, *Liebmann* 585, this is a form with geniculate branching culms of what in this country has passed most commonly for *B. bromoides*. *Karwinski* 991b and *Liebmann* 585 are in the St. Petersburg Botanical Garden, and the latter number is also in the Berlin Herbarium. The type, *Karwinski* 991b, has not been examined.

Vasey[a] describes and figures this species under the name *Bouteloua humboldtiana* Kunth.

DESCRIPTION.

An erect and cespitose or geniculate and spreading perennial, with branching culms and with a more limited root system than *B. radicosa;* culms erect or spreading, unbranched, 30 to 50 cm. high; sheaths smooth, striate, close; blades narrow, 1.5 to 2 mm. wide, delicate, with papillose hairs regularly distributed upon the margin; ligule a ring of white hairs 1 mm. long or less; spikes commonly 8 mm. wide and 15 mm. long, but often 2 cm. long; spikelets about 10, not pectinate, 12 to 14 mm. long, consisting of one perfect lower floret and an upper staminate one; glumes strongly hispidulously keeled, acuminate-pointed but not awned, nearly equal; lemma about 7 mm. long, hispidulous on the nerves toward the apex, 3-nerved, 3-awned, the lateral awns short and the central 1 mm. longer; palet as long as its lemma, toothed but scarcely awned; rudiment consisting of a well-developed staminate floret with a simple, undivided projection of the rachilla 1 mm. long extending above its insertion; lemma of the staminate floret narrower and more conspicuously awned than that of the lower floret, 7 to 8 mm. long over all, the central awn 1 to 2 mm. longer than the lateral, its palet being about the same as that of the perfect floret; caryopsis about 4 mm. long and 1 mm. wide, the scutellum covering about three-fourths of the ventral surface. (Plates 82, A, 83.)

The species is variable, especially in habit, and has an extensive range from Texas to California and south into South America. In Arizona and the highland of northern Mexico it is an erect plant.[b]

The typical form, that is, the form with geniculate culms growing in favorable situations, is uncommon. There is a slight difference in leafage and color between forms from the United States according as they grow in the deserts, or upon the more fertile soils of southern Texas. In the latter situation, under cover of brush, the whole plant becomes more lax and has a tendency to become geniculate in habit, like the typical form of the species which is familiar to me in western Jalisco.

The following, all from Mexico, appear to be typical of the species: *Liebmann* 585, Consoquitla, and 575, valley of Oaxaca. *Palmer* 1254, Colima; 113, Acapulco; 482, Tamaulipas. *Botteri* 107, Orizaba; *Nelson*, Atlixco, July 25 to August 1, 1903.

HERBARIUM SPECIMENS.

Arizona: *Hitchcock* 3499, Tucson; 3692, Patagonia. *Griffiths* 3441, 3386, Santa Rita Forest Reserve; 1470, Rincon Mountains; 1949, Pearce. *Griffiths & Thornber* 3, Santa Rita Forest Reserve. *Lemmon* 373. *Mearns* 931, south of Bisbee. *Nealley* 267, Monmouth. *Rothrock* 484, Camp Bowie. *Davis* 562, Clifton. *Chase* 5515, Tucson.

[a] U. S. Dept. Agr. Div. Bot. Bull. 12[1]: *pl. 40.* 1890.

[b] See discussion under *Bouteloua americana.*

Explanation of Plate 82.—**A**, *Bouteloua filiformis* in lower foothills in southern Arizona upon stony embankments, growing mainly with *Leptochloa dubia* and *B. curtipendula.* B, *Bouteloua curtipendula,* an uncommonly large bunch from near Greaterville, Arizona.

Explanation of Plate 83.—*a,* Habit sketch of *Bouteloua filiformis*; *b,* spikelet; *c, d,* lemma and palet of first floret; *e, f,* lemma and palet of second floret; *g,* two views of caryopsis; *h,* portion of leaf blade. *a,* One-fourth natural size; *b–f,* scale 5; *g,* scale 7.5; *h,* scale 2.5. From *Griffiths* 7199.

TEXAS: *Havard* 89, Eagle Pass.

MEXICO: *Pringle* 2547, valley of Monterey; *Palmer* 482, Victoria; 1254, Colima; 201, Guaymas; 65, Chihuahua. *Liebmann* 585, Consoquitla; 575, valley of Oaxaca. *Botteri* 107, Orizaba. *Nelson*, Puebla. *Hartman* 30, Fronteras. *Brandegee* 29, Miraflores, Lower California. *Schumann* 1741, Parral. *Schaffner* 1003, San Luis Potosí. *Rose & Painter* 6538, 6821 (in part) valley of Mexico.

NICARAGUA: *Baker* 2319, Granada.

GUATEMALA: *Heyde & Lux* 628 in J. D. Smith, Plant. Guat. *Deam* 6132, Aguascalientes. *Kellerman* 4784, Department Amatitlan.

YUCATAN: *Schott* 659, 742, Uxmal; 656, Merida.

COSTA RICA: *Tonduz* 13745.

SOUTH AMERICA: *Pittier* 643, State of Cauca, Colombia.

32. Bouteloua heterostega (Trin.).

Heterosteca juncifolia Desv. Nouv. Bull. Soc. Philom. Paris **2**: 188. 1810, not *Bouteloua juncifolia* Lag. 1816. In 1813 Desvaux [a] reduces this to a synonym of *Heterosteca americana*, but he was not justified in so doing according to our present conception of species. Kunth [b] appears to have interpreted Desvaux correctly and figures the plant so common in the western portion of the island of Cuba, but made the mistake of including with it *Aristida americana* L. Desvaux's original description of the genus Heterosteca would exclude the Linnæan plant.

? Bouteloua juncifolia Lag. Gen. & Sp. Nov. 5. 1816. It seems impossible to determine what this is. Lagasca does not mention Desvaux and it does not appear probable to me that he and Desvaux had the same species. Lagasca's type comes from a region to the north of the known distribution of *Bouteloua heterostega* as here interpreted.

? Actinochloa juncifolia Roem. & Schult. Syst. Veg. **2**: 420. 1817. Based upon *Bouteloua juncifolia* Lag.

Eutriana heterostega Trin. Gram. Unifl. 242. 1824. Based upon *Heterosteca juncifolia* Desv.

Atheropogon juncifolius Spreng. Syst. Veg. **1**: 294. 1825. Based upon "*Heterostega juncifolia* Desv. et Kunth."

Eutriana juncifolia Kunth, Rév. Gram. **1**: 95. 1829. Based upon *Heterosteca juncifolia* Desv.

? Eutriana? lagascae Kunth, Rév. Gram. **1**: 95. 1829. Based upon *Bouteloua juncifolia* Lag.

Dineba juncifolia Beauv.; Steud. Nom. Bot. ed. 2. **1**: 510. 1840. A name only given as synonym of *Eutriana juncifolia*.

Bouteloua humboldtiana Griseb. Mem. Amer. Acad. n. ser. **8**: 532. 1862. (Pl. Wright. Cub.) The type is *Wright* 734 in the Grisebach Herbarium. Number 739 is also mentioned. *Wright* 739 in the herbarium of the Paris Muséum has both wide and narrow spiked forms on the same sheet. The species is the wide-spiked form typical of *Heterosteca juncifolia* Desv., of which Kunth gave good figures.[b] Both numbers are from the island of Cuba. Duplicates of both numbers as well as of *Wright* 3816 (described as a different species) are in the Gray Herbarium. This should not be confused with *Chondrosium humboldtianum* Kunth, which is based upon *Dinebra chondrosioides* H. B. K.

Bouteloua porphyrantha Wright, Anal. Acad. Cienc. Habana **8**: 201. 1871; Sauv. Fl. Cub. 192. 1873. The type is a part of *Wright* 739. Duplicates of this number and of the other specimens cited by Grisebach, *Wright* 734 and 3816, are well represented in

[a] Journ. de Bot. **1**: 68. 1813.

[b] H. B. K. Nov. Gen. & Sp. **1**: 173. *pl. 54.* 1816.

the Gray Herbarium and in the National Herbarium. Number 739 in the herbarium of the Paris Muséum, as stated above, has, on the same sheet, both wide[a] and narrow[b] spikes, common in this species.

Atheropogon americanus depauperata[*us*] Fourn. Mex. Pl. **2**: 139. 1881. Fournier cites *Bouteloua juncifolia* Lag. and *Eutriana lagascae* Kunth as synonyms. He mentions two specimens, the first is one from Karwinski in the St. Petersburg Herbarium with neither number nor locality; the other is *Wright* 739. It is evident from his description and the citation of the last specimen that he had in mind *Bouteloua porphyrantha* Wright. He is evidently wrong in his interpretation of Lagasca.

Heterosteca rhadina Nash, Bull. Torrey Club **30**: 386. 1903. Heller's no. 6057, near Ponce, Porto Rico, in the New York Botanical Garden, is the type. Duplicates are widely distributed. Some of these duplicates show the same facts exhibited by *Wright* 739 in the herbarium of the Paris Muséum.

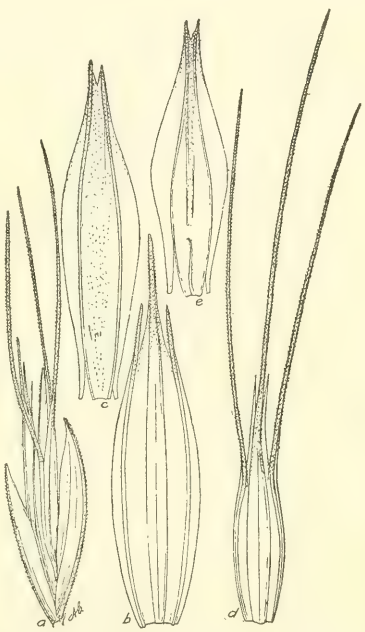


FIG. 59.—*Bouteloua heterostega*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, *e*, lemma and palet of second floret (rudiment attached to palet). *a*, Scale 5; *b–e*, scale 7.5. From *León* 861.

DESCRIPTION.

Plants mostly low, spreading, sometimes erect, but mostly reclined, and often nearly prostrate and stoloniferous, perennial; culms freely branching; spikes 4 to 10, variable, 1.5 to 3 cm. long, 2 to 6 mm. wide; spikelets 4 to 7, about 12 mm. long including awns, 2-flowered, the lower perfect or pistillate, the upper staminate; glumes nearly equal, scabrous-keeled; lemma of lower floret short-awned, with lateral awns shorter than the central, smooth, coriaceous, about 8 mm. long; lemma of upper floret smooth, coriaceous 10 to 12 mm. long, with long awns, the lateral slightly shorter than the central; palet smooth, 8 mm. long, very short-awned sulcate, on the back between the two nerves, the edges involute; caryopsis about 3 mm. long, 0.7 mm. wide, pointed below and contracted above (immature). (FIGURE 59.)

The species, as it occurs in the West Indies, is very variable in every particular. The spike and spikelet characters are especially subject to variation. The above characterization is drawn from Brother León's no. 861 in so far as spike and details are concerned, amended from *Curtiss* (West Indian Plants) 546 and others, as to plant characters. The Curtiss specimen in the National Herbarium shows two distinct forms of spikes, one as here described and figured, and the other resembling *B. americana*. Kunth figured[c] the wide-spiked form. The majority of the specimens show a true perennial character, while *B. americana* is evidently an annual. In habit and general aspect the species presents all sorts of variations from an erect plant, with branching culms, to a low prostrate plant, with often long-geniculate to prostrate

[a] *Bouteloua humboldtiana* Griseb.

[b] *Bouteloua porphyrantha* Wright.

[c] H. B. K. Nov. Gen. & Sp. **1**: 173. *pl. 54*. 1816.

culms, having profuse proliferations at each node. Rooting often occurs on these nodes making the plants appear stoloniferous, and a short scaly rootstock is sometimes seen, as in the Hitchcock specimen collected at Triscornia, Cuba, March 23, 1906. The Tracy specimen, mentioned below, has spikes with very long awns closely resembling those of *B. radicosa*. See discussion under *B. americana*.

HERBARIUM SPECIMENS.

WEST INDIES: *Wright* 739, Cuba; *Hitchcock* 452, Triscornia, Cuba; 460, Playa de Cojimar, Cuba. *Tracy* 9088, Triscornia. *Sintenis* 2269, 2203, and 1959, Porto Rico. *Curtiss* 546, Habana, Cuba. *Duss* 1326, Martinique. *Heller* 6057, Porto Rico. *León* 293 and 861, Habana.

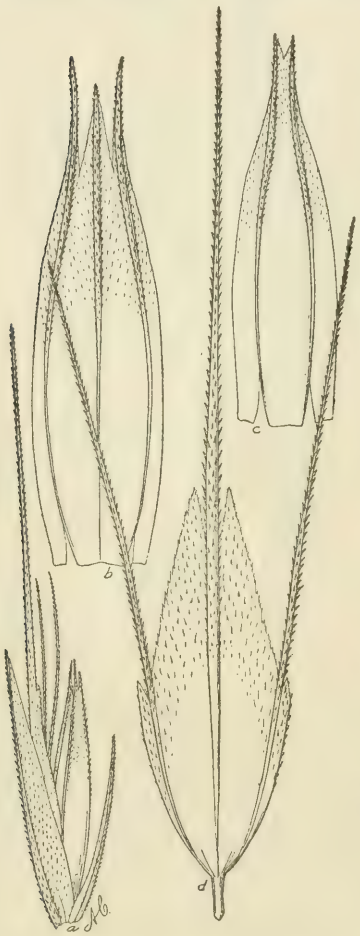


FIG. 60.—*Bouteloua disticha*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, rudimentary floret. *a*, Scale 5, *b–d*, scale 10. From *Schott* 741 in Field Museum Herb.

33. Bouteloua disticha (H. B. K.) Benth.

Dineba divaricata Beauv. Ess. Agrost. 160. 1812. No description is given; the name appears only in the index, where in his private copy of this work Beauvois has written "=disticha," which I interpret to mean *Polyodon distichum* H. B. K.

Polyodon distichum H. B. K. Nov. Gen. & Sp. **1**: 175. *pl. 55.* 1816. I consider the specimens seen to be easily identified from Kunth's figures and description.

Eutriana polyodon Trin. Gram. Unifl. 242. 1824. Based upon *Polyodon distichum* H. B. K.

Atheropogon distichus Spreng. Syst. Veg. **1**: 294. 1825. Based upon *Polyodon distichum* H. B. K.

Bouteloua disticha Benth. Journ. Linn. Soc. Bot. **19**: 105. 1881. Based upon *Polyodon distichum* H. B. K. See also Field Mus. Bot. **3**: 53. 1903.

DESCRIPTION.

An erect, cespitose perennial, about 30 cm. high, with sparingly branched culms; sheaths striate, papillose-hairy, rather loose; blades comparatively broad, flat, scabrous on the edges, with conspicuous papillose hairs, especially toward the base and on the edges; ligule a rather conspicuous collar with a fringe of ciliate hairs; inflorescence racemose; spikes about 25 in number; bilateral but sometimes appearing unilateral, about 1.5 cm. long including awns, spikelets 5 to 8, not pectinate, but more or less fascicled, the lower being small and mostly rudimentary, but the upper more perfectly developed, the upper florets of the spikelets above the two lower ones usually with long-awned lemmas so disposed as to make the spike appear bilaterally

symmetrical; glumes scabrous-keeled, the first reduced nearly to an awn, 5 mm. long, the second wider, 7 to 8 mm. long; lemma 5 to 6 mm. long, smooth, with 3 short awns, the lateral awns slightly longer than the central; upper floret simply a 3-awned rudiment with a few scales at base or a well-developed perfect floret, but always, except in the lower spikes, bearing a long central awn, the lemma, including awn, 10 to 14 mm. long, the lateral awns often not more than 6 or 7 mm. long. (FIGURE 60.)

The first specimen of this species which I have recognized is *Schott* 741, in the herbarium of the Field Museum of Natural History. The floral characters of *B. disticha* are exceedingly variable, as is true of many of the species of this group. The description is drawn from the upper spikelets. The lower ones are small and often staminate only, the rudiment being reduced to three imperfectly developed, short awns.

The species is exceedingly rare in collections. The chief diagnostic character is the inflorescence and the apparent bilateral arrangement of the spikelets, which is admirably brought out in Kunth's figures.

Besides the Schott specimen the following are typical: *Curtiss* 537, from Cuba; *Pittier* 10374, from Costa Rica; and *León* 299, from Cuba. *Pittier* 2537, Canal Zone, is a geniculate form with branching culms.

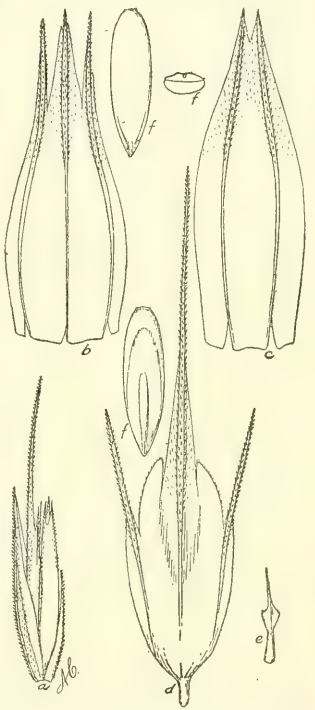


FIG. 61.—*Bouteloua pilosa*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, rudimentary second floret; *e*, rudimentary floret of lowermost spikelet; *f*, two views and cross section of caryopsis. *a*, Scale 5; *b–f*, scale 10. From *Snodgrass & Heller* 655 in Gray Herb.

34. Bouteloua pilosa (Hook.) Benth.

Eutriana pilosa Hook. f. Trans. Linn. Soc. Bot. **20**: 173. 1851; Steud. Syn. Pl. Glum. **1**: 216. 1854. The Macrae specimen from Albemarle Island, cited by Hooker, has not been examined. My knowledge is based upon *Andersson* 46, from Galapagos, and *Fendler* 2571, from Venezuela, in the Grisebach Herbarium. More recently many fine specimens have been examined in the Gray Herbarium from the Hopkins Galapagos Expedition (*Snodgrass & Heller* 655).

Eutriana gracilis Hook. f. Trans. Linn. Soc. Bot. **20**: 175. 1851, not *Bouteloua gracilis* Hook.[a] nor Lagasca.[b] The type of this species has been examined through the courtesy of the director of the Royal Botanic Gardens of Kew, England.

Bouteloua pilosa Benth.; Wats. Proc. Amer. Acad. **18**: 179. 1883. Based upon *Eutriana pilosa* Hook. f.

DESCRIPTION.

An erect, cespitose, smooth annual(?) 20 to 40 cm. high; culms slender, often branching; sheaths close; blades flat, thin, often 10 cm. long, the ligule an inconspicuous ring of short hairs; inflorescence racemose, 10 to 20 cm. long; spikes variable, from 15 to 35, bilateral, on a zigzag rachis, but usually appearing unilateral;

[a] Vasey in Wheeler, Rep. U. S. Surv. 100th Merid. **6**: 287. 1878.
[b] Steud. Nom. Bot. ed. 2. **1**: 219. 1840.

spikelets 3 to 5, consisting of a lower perfect floret and an upper rudiment; glumes narrow, hispid, keeled, the first about 3 mm., and the second about 5 mm. long, smooth, with 3 short, hispid awns, the central awn not over 0.5 mm. longer than the lateral; palet the same length as its lemma, with two short awns from the two nerves; rudiment usually consisting of a single 3-awned lemma, the central awn being by far the most important, often 9 to 10 mm. long, the lateral awns only 2 mm. long, infolded; caryopsis flattened, 1.75 mm. long, 0.5 mm. wide, the small scutellum covering only about one-third of the ventral surface. (FIGURE 61.)

The description is drawn from *Snodgrass & Heller* 393, James Island, Galapagos, April, 1899. This appears to be a good, average specimen, although it does not cover all of the many variations. The spikelet described is from the middle of the spike. In the lower spikelet the rudiment is usually much smaller than described, at times even reduced to a single awn half as long as the perfect floret. It is exceedingly variable and is more closely related to *B. curtipendula* than to any other species. The Hopkins Galapagos Expedition furnished a fine series of specimens, the best representatives of which are in the Gray Herbarium. Some of them might be considered annual, but no. 507 is clearly perennial. In general aspect this certainly looks like *B. curtipendula.*

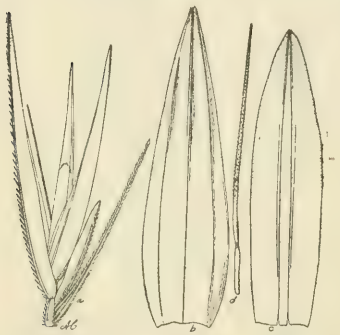


FIG. 62.—*Bouteloua uniflora.* *a*, Spike, of single spikelet with prolongation of rachis; *b*, *c*, lemma and palet; *d*, rudiment. *a*, Scale 5; *b–d*, scale 13. From type specimen.

35. Bouteloua uniflora Vasey.

Bouteloua uniflora Vasey, Bot. Gaz. **16**: 26. 1891. The type is *Nealley* 222, Crockett County, Texas, 1890, in the National Herbarium. See also U. S. Dept. Agr. Div. Agrost. Bull. 7: 212. *f. 194.* 1897.

DESCRIPTION.

A tall, smooth, tufted, erect perennial, with the habit and general appearance of *B. curtipendula;* culms simple or branched at the very base, 35 to 50 cm. high; sheaths striate, smooth or minutely rough-hispid under a lens, the ligule reduced to a ring of short, flexuous, white hairs; blades variable, from 2 to 10 cm. long, the longest above, striate, minutely hispid, especially on the upper surface and on the involute edges, the latter being also sparsely papillose-ciliate; panicle racemose, exactly like that of *B. curtipendula* excepting for the smaller spikes; spikes 25 to 35, 8 to 9 mm. long, consisting of a 1-flowered spikelet and a hispid, closely appressed prolongation of the rachis, about 4 mm. long; second glume 7 to 8 mm. long, 1 mm. wide, acuminate, the first about 3 mm. long, 0.8 mm. wide, with a more rounded apex; lemma smooth, 3-nerved, very short-awned or awnless, about 6 mm. long, with a narrow, 2-toothed, smooth palet, about 5 mm. long; rudiment consisting of a single, simple, hispid awn about 4 mm. long; caryopsis not known. (FIGURE 62.)

The specimen is immature, and it is barely possible that it may turn out to be an aberrant form of *B. curtipendula.* *Bigelow*, "Rio San Pedro, Texas," November 5, 1850, in the herbarium of S. M. Tracy, from the Thurber Herbarium, is the same as the type in every floral detail, but the spikes are more numerous. No collections other than these two have been seen.

36. Bouteloua curtipendula (Michx.) Torr.

Chloris curtipendula Michx. Fl. Bor. Amer. **1**: 59. 1803. The type, collected in Illinois, is in the Michaux Herbarium.

Bouteloua racemosa Lag. Var. Cienc. **2**[4]: 141. 1805. Lagasca cites *Chloris curtipendula* as a synonym in his later paper.[a]

Bouteloua pendula "H. R. M." Lag. Var. Cienc. **2**[4]: 141. 1805. A garden name published as a synonym of *B. racemosa*.

Atheropogon apludioides Muhl.; Willd. Sp. Pl. **4**: 937. 1806; Jacq. Eclog. Gram. 8. *pl.* 7. 1814; Roem & Schult. Syst. Veg. **2**: 413. 1817; Spreng. Syst. Veg. **1**: 293. 1825. A good list of correctly referred synonyms is given by Jacquin.

Bouteloua melicaeformis Brauss.; Hornem. Enum. Pl. Hort. Hafn. 7. 1807. I follow Roemer and Schultes,[b] who place this as a synonym under *Atheropogon apludioides*. Only a name is listed.

Bouteloua melicoides Beauv. Ess. Agrost. 40. *pl. 9. f. 6.* 1812. Based upon "Bout. *melicoides* Horn." (evidently an error for "melicaeformis"). Beauvois's figures, however, do not apply to *B. curtipendula*. They resemble more closely some species of the *B. procumbens* group. In his private copy of the Agrostographie Beauvois has written in his own hand "=Atheropogon apludioides." This name was later listed, with Muhlenberg as the author, by Steudel[c] as a synonym of *Atheropogon apludioides*.

Dineba curtipendula Beauv. Ess. Agrost. 98, 160. 1812. Presumably based upon *Chloris curtipendula* Michx., though Beauvois erroneously cites "Melica *curtipendula* Mich." See also DC. Cat. Hort. Monsp. 105. 1813 (where the generic name is spelled "Dinebra"); H. B. K. Nov. Gen. & Sp. **1**: 171. 1816; Presl. Rel. Haenk. **1**: 292. 1830.

Dineba melicoides? Beauv. Ess. Agrost. 160. 1812. A name only, given in the index.

Atheropogon racemosus Roem. & Schult. Syst. Veg. **2**: 414. 1817. Based upon *Bouteloua racemosa* Lag.

Eutriana curtipendula Trin. Fund. Agrost. 161. 1820. Based upon *Chloris curtipendula* Michx. See also Steud. Syn. Pl. Glum. **1**: 215. 1854.

Melica curtipendula Michx.; Steud. Nom. Bot. **1**: 91, 519. 1821. Based upon *Chloris curtipendula* Michx. This name was earlier erroneously given by Beauvois (see above under *Dineba curtipendula*).

Bouteloua curtipendula Torr. in Emory, Mil. Reconn. 154. 1848; U. S. Dept. Agr. Div. Bot. Bull. **12**[1]: *pl. 43.* 1890; Britt. & Brown, Illust. Fl. **1**: 180. *f. 413.* 1896; U. S. Dept. Agr. Div. Agrost. Bull. **7**: 213. *f. 195.* 1897.

Eutriana affinis Hook. f. Trans. Linn. Soc. Bot. **20**: 174. 1851; Steud. Syn. Pl. Glum. **1**: 215. 1854. The original description states that this is closely allied to *E. curtipendula*. Our present conception of this species would include the form described by Hooker. It is said to be identical with *Atheropogon apludioides*, *Heterostegon curtipendulus*, and *Eutriana curtipendula* of Schweinitz in the Hooker Herbarium. It is based upon Drummond specimens from Missouri and Texas.

Heterostegon curtipendulus Schwein.; Hook. f. Trans. Linn. Soc. Bot. **20**: 175. 1851. A name only.

Bouteloua curtipendula aristosa A. Gray, Man. Bot. ed. 2. 553. 1856. This is the typical form in the mountains of the Southwest, but even there the awns often drop off toward maturity. One can establish many varieties in any of these species if he choose, but it appears better not to recognize this form as a subspecies.

Atheropogon curtipendulus Fourn. Mex. Pl. **2**: 138. 1881. Based upon *Bouteloua curtipendula* A. Gray. *Schaffner* 535 and *Bourgeau* 2755, cited by Fournier, are in the herbarium of the St. Petersburg Botanical Garden.

[a] Gen. & Sp. Nov. 5. 1816. [b] Syst. Veg. **2**: 414. 1817. [c] Nom. Bot. **1**: 117. 1821.

* Andropogon curtipendulum Spr.; Steud. Nom. ed. 2. 1: 90. 1840. as syn. Eutriana curtipendula

Eutriana racemosa Trin.; Fourn. Mex. Pl. 2: 141. 1881. A name only. According to Hitchcock's notes on the Trinius Herbarium, Trinius's specimen labeled *E. racemosa* is there put in the cover with *B. curtipendula*, to which species it belongs. (See *Triathera gracilis* under *Triaena juncea*.)

Atheropogon affinis Fourn. Mex. Pl. 2: 141. 1881. Based upon *Eutriana affinis* Hook.

DESCRIPTION.

A tall, erect, cespitose perennial, 50 to 80 cm. high, spreading by strong, scaly, creeping rootstocks; sheaths rather close, prominently striate, smooth, the ligule ciliate-fringed; blades abundant, 10 to 30 cm. long, smooth or very minutely scabrous, about equally distributed over the culm; panicle racemose, 15 to 25 cm. long, with flattened axis; spikes 35 to 50, bilaterally arranged on the flattened axis, but the delicate peduncles so twisted and curved as to make them unilateral, 1 to 2 cm. long; spikelets bilateral on a flattened rachis, but not pectinate, 5 to 8, consisting of one fertile floret and a rudiment; glumes scabrous-keeled, the first 4 to 5 mm., the second about 7 mm. long; lemma minutely 3-awned, the central awn but little longer than the lateral, 5 to 6 mm. long, smooth to slightly scabrous on the nerves toward the apex; palet acuminate, scabrous above; the rudiment reduced to a minute scale with a delicate scabrous awn, and a rudimentary palet consisting of 2 very delicate awns; caryopsis elliptical, about 4.5 mm. long, 1.5 mm. wide, the scutellum covering two-thirds to three-fourths of the ventral surface. (PLATE 69, A, facing p. 345; 82, B, facing p. 413. FIGURE 63.)

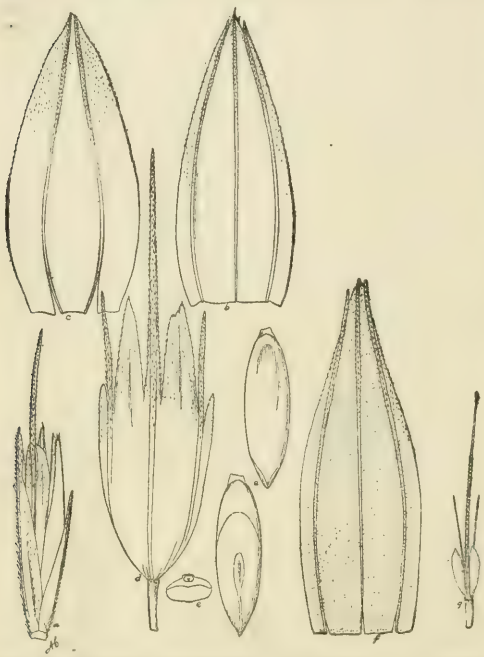


FIG. 63.—*Boutcloua curtipendula*. *a*, Spikelet; *b*, *c*, lemma and palet of first floret; *d*, rudimentary second floret; *e*, two views and cross section of caryopsis; *f*, *g*, lemma and rudiment from a different plant. *a*, Scale 5; *b–g*, scale 8. *a–e*, From *Griffiths* 7261; *f*, *g*, from *Griffiths* 7071.

The common "side-oat grama" has a distribution in area second only to *B. hirsuta*. It is abundant from Illinois and Ontario westward and southward far into South America and has been collected as far east as New York and Connecticut. It is an important native forage in many places. Being of good quality and a large, vigorous grower, it is one of the most promising species for domestication, but, like all the others of this genus, it has the important disadvantage of poor seed habits. Besides being produced in small amount, the seed is difficult of separation from the chaff. In all attempts that have been made to establish meadows of it—and there have been a number in an experimental way—no attempts have been made to thrash the seed at all. The spikes, which readily separate from the culms of maturity, have been gathered and sown.

The species is distinct and characteristic, and there are none with which it may be easily confused. Its general aspect is distinct and easily recognized, but the minuter characteristics of the spikelets are most variable. The above description was drawn from *Griffiths* 7071, which corresponds very imperfectly with the drawings of *Griffiths* 7261, published herewith, especially in the character of the rudiment. The latter form is the variety *aristosa*, which it does not seem wise to recognize as a subspecies on account of its extreme variation and the intergradations between it and the typical form.

As would be expected in a plant of such wide distribution, there are great variations in many if not all of the ordinary taxonomic characters. The accompanying text figures show some of these in so far as they relate to the floral structures. As a rule, the general plant body would be pronounced smooth, but often the leaves and sheaths are quite densely papillose-hairy. A specimen collected by Dr. Short in Kentucky ("Knob of the Crab Orchard"), and another, *MacDougal* 273, Flagstaff, Arizona, both show the development of this character. It frequently occurs that the leaves have conspicuously serrate edges, or have regularly placed papillose hairs on the edges. *Shear* 707, Osborne, Kansas, is a good example of the development of the latter character. A specimen collected by Eggert in Jefferson County, Missouri, August, 1891, in the herbarium of the Missouri Botanical Garden, has pronounced papillose hairs on the edges of the leaves and very wide spikes, but other plants of the same collection have short spikes and look very peculiar for this species. A specimen in the same herbarium, collected by Bush in McDonald County, Missouri, July 24, 1903, is especially hairy on both the leaves and the sheaths. This condition is to be distinguished from that of the Eggert specimen above. The hairs are papillose also, but occur on the lower side of the leaves and the upper portion of the sheaths. There is none of this in the Eggert specimen. A specimen from Eggert in same herbarium from St. Clair, Illinois, is very similar to the Bush plant.

HERBARIUM SPECIMENS.

ARIZONA: *Blumer* 1671, Chiricahua Mountains. *Hitchcock* 3497, Tucson; 3655, Patagonia. *Tidestrom* 925, Jerome Junction. *Nealley* 1661, Monmouth, Rincon Mountains. *MacDougal* 799, Dos Cabezos; 273, Flagstaff. *Parish* 318. *Chase* 5825, Indian Gardens, Grand Canyon. *Griffiths* 3373, Santa Rita Forest Reserve; 1438, Benson; 1837, Dragoon Mountains; 1907, Cochise. *Holzner* 1569, Huachuca Mountains. *Knowlton* 1961, San Francisco Mountains. *Davidson* 306, Clifton. *Griffiths & Thornber* 188 and 189, Santa Rita Mountains. *Leiberg* 5734, San Francisco Mountains. *Jones* 6066, Canaan Ranch. *Mearns* 859, 1065, south of Bisbee; 1118, San Pedro River, Mexican Boundary. *Zuck* 30, Holbrook.

CALIFORNIA: *Hall* 2138, San Jacinto Mountains.

COLORADO: *Chase* 5310, Manitou; 5408, Las Animas County. *Tidestrom* 66, Hugo. *Clements* (Herb. Form. Colo.) 2. *Crandall* 3541, Fort Collins. *Hitchcock* 1792, Pikes Peak. *Jones* 548, Morrison. *Tweedy* 376, Durango. *Griffiths* 3311, Rocky Ford. *Shear* 969, Canyon City; 948, Salida. *Williams* 2165 and 2120, Colorado Springs. *Baker, Earle & Tracy* 970, Durango.

CONNECTICUT: *Bissell*, Housatonic River near Oxford.

ILLINOIS: *Hill* 181 in 1896, Will County. *V. H. Chase*, 1875, Princeville. *Gleason* 1001, Havana. *McDonald* 60, Peoria. *Skeels* 534, Joliet. *Waite*, Ogle County in 1887. *Wilcox* 62, Manitou.

INDIANA: *Dormer* 58, Elston.

IOWA: *Fink* 433, Fayette. *Morris* A255, Murray to Thayer. *Pammel & Cratty* 756, Ledyard. *Ball* 1008, Manchester. *Pammel* 645, Des Moines.

KANSAS: *Hitchcock* 3852, Manhattan. *Stevens* (in Seymour's Grasses) 32, Manhattan. *Smyth* 285, Caldwell; 60, Hutchinson. *Shear* 146, 707, Osborne. *Norton* 910, Riley County. *Thompson* 127, Syracuse; 57, Ulysses.

MICHIGAN: *Wheeler*, Jackson County.

MINNESOTA: *Moyer*, Montevideo. *Mearns* 738, Fort Snelling.

MISSISSIPPI: *Tracy* 1392, Starkville.

MONTANA: *Blankinship* 172, Upper Big Horn River.

NEBRASKA: *Rydberg* 2521, North Platte; 1499, Thomas County. *Clements* 2701, Brazile Creek.

NEW JERSEY: *Van Sickle* (July 27, 1893), Zinc Mines. *Porter*, below Philipsburg.

NEW MEXICO: *Wooton & Standley* 3525, Lincoln County; 3979, Dona Ana County. *Hitchcock* 3802, Organ Mountains. *Standley* 4904, San Miguel County. *Fisher* 17, Tucumcari. *Earle* 97 and 94, Gray. *Wooton* 337, Lincoln County; 2945, Fairview; 2922, Santa Fe; 1096, Organ Mountains. *Metcalfe* 640, Mangas Springs. *Mearns* 345, White Water.

NORTH DAKOTA: *Stockbridge* 1875, Fargo. *Brannon* 107, Minot. *Geyer* (1839), near Devils Lake.

NEW YORK: *Wibbe*, Schenectady.

OHIO: *Moseley*, Marblehead.

PENNSYLVANIA. *Commons* 324, Birmingham. *Heller & Halbach* 704, Lancaster County. *Pennell* 569, Chester County.

SOUTH DAKOTA: *Bruce* 14, Jamesville, Yankton County. *Wallace* 9, Indian Creek; 10, Medicine Horse Creek. *Griffiths* 61, Frankfort; 67, Redfield; 285, White Horse Creek; 768, Pierre, 83, Aberdeen. *Wilcox* 4, Brookings.

TEXAS: *Ball* 1152, Chillicothe. *Tracy* 8106, Abilene; 7744, Pierce. *Heller* 1762, Kerrville. *Jermy* 94, San Antonio. *Wright* 756, West Texas. *Hall* 772, Dallas. *Bailey* 741, Guadalupe Mountains. *Plank* 94, Del Rio; 66, El Paso. *Mearns* 1212, Fort Clark. *Lindheimer Exsic.* 568. *Nealley*, College Station.

UTAH: *Jones* 5700, Capitol Wash.

WYOMING: *Chase* 5272, Sundance. *A. Nelson* 530, Whalen Canyon; 8432, Laramie County. *Griffiths* 525, Devils Tower; 697, Newcastle; 494, Sundance; 410, Beulah: *E. Nelson* 479, Laramie County. *Williams* 2587, Sundance.

MEXICO: *Palmer* 503, Jalisco; 114 and 206, Chihuahua; 861, Carmen Island; 371 and 407, Saltillo; 264, Conception del Oro; 194, Durango. *Lloyd* 201, 239, 213, Cedros, Zacatecas. *Hitchcock* 3609, Hermosillo; 3633, Nogales. *Holway* 10, Tula. *Pringle* 408, Chihuahua. *Schumann* 1721, Parral. *Pittier* 444, Esperanza. *Brandegee*, San José del Cabo, Lower California. *Mearns* 1039, San José Mountains, Sonora; 2305, near White Water, New Mexico; 520, San Luis Mountains. *Seaton* 113, Orizaba. *Smith* 958, Oaxaca. *Bourgeau* 491, Santa Fé. *Liebmann* 580, Tehuacan. *Orcutt* 671, Topo Mountains, Lower California. *Nelson* 1799, Cuicatlan; 6247, Colonia Garcia, Chihuahua. *Rose* 2929, Bolanos, Jalisco.

CANADA: *Herriot*, Galt, Ontario.

GUATEMALA: *Hyde & Lux* 3930 (in J. D. Smith's Plants of Guatemala.)

SOUTH AMERICA: *Bang* 998, Bolivia. *Stuckert* 5877, Argentina. *Pittier* 1529, Colombia.

EXCLUDED NAMES.

The following names belonging to or likely to be looked for in this group are excluded for the reasons enumerated:

Aristida minuta Poit.; Roem. & Schult. Syst. Veg. 2 : 711. 1817. Listed as a synonym of *Dineba secunda.*

Aristida secunda Ledeb.; Steud. Nom. Bot. ed. 2. 1 : 132. 1840. Given as a synonym of *Eutriana ledebourii.*

Atheropogon antillarum Spreng. Syst. Veg. **1**: 294. 1825. *Aristida antillarum* Poir. is cited as a synonym. Probably a species of Aristida from the West Indies.

Atheropogon medius Fourn. Mex. Pl. **2**: 139. 1881. This may be a form of *Bouteloua aristidoides*, but it can not be determined with any degree of certainty.

Atheropogon villosus Steud. Nom. Bot. ed. 2. **1**: 167. 1840. The name is credited to "Nees" and given as a synonym of "*Eutriana villosa*."

Chondrosium virletii Fourn. Mex. Pl. **2**: 136. 1881. I have not been able to find authentic material of this, although specimens are cited. The type is *Virlet* 1373, from San Luis Potosi, Mexico. Some portions of the description suggest a form of *B. trinii*.

Chondrosium subscorpioides C. Müll. Bot. Zeit. **14**: 347. 1856. This is probably *Bouteloua gracilis*, but there is nothing certain about it. It is from California.

Corethrum Vahl, Skrivt. Naturh.-Selsk (Kjøbenhavn) **6**: 85. 1810. This is listed in the Index Kewensis as a synonym of Bouteloua, but both the description and the locality (Syria) indicate that it does not belong to this group.

Corethrum bromoides Vahl, Skrivt. Naturh.-Selsk. (Kjøbenhavn) **6**: 85. 1810. The Index Kewensis refers this to *Bouteloua bromoides*, but the description does not admit the plant into this group.

Cynosurus retroflexus Vahl, Symb. Bot. **2**: 20. 1791. This is from the East Indies. Both the locality and Vahl's description indicate that it does not belong to this group.

Cynosurus secundus Pursh, Fl. Amer. Sept. **2**: 728. 1814. It is not possible for me to identify this from the description. It is probably not a member of our group, although by some it has been referred to *B. curtipendula*. It may be said that *B. curtipendula* is listed by Pursh under two other genera, viz, *Atheropogon* and *Chloris*. Nuttall[a] refers this doubtfully to *Atheropogon apludioides*.

Dactylis paspaloides Willd.; Kunth, Rév. Gram. **1**: 91. 1829. Given as a synonym of *Leptochloa arabica*. This has been erroneously referred to this group by some authors.

Deyeuxia brasiliensis Steud. Nom. Bot. ed. 2. **1**: 620. 1840. A name from Sprengel's herbarium given as a synonym of *Eutriana villosa* according to Trinius's manuscript.

Dinebra Jacq. Fragm. 77. *pl. 121. f. 1.* 1809. This is a genus of Chlorideae to which various authors have referred species of Bouteloua, but which is not allied to this group. Beauvois[b] spells the name Dineba (the original Arabic spelling) giving Delile as the author, and this spelling is followed by Presl. Kunth spelled the name as did Jacquin.

Dineba aegyptica Delile, Descr. Egypt. **4**: 26. *pl. 11. f. 3.* 1813. This does not belong here, although repeatedly placed here in the past.

Dineba arabica Beauv. Ess. Agrost. 98. *pl. 16. f. 2.* 1812. The plant figured by Beauvois does not belong in this group. See Bentham's opinion of this.[c]

Dinebra brevifolia Steud. Syn. Pl. Glum. **1**: 299. 1854. This is from Abyssinia, and probably is not a member of this group.

Dinebra calycina Wight; Nees, Proc. Linn. Soc. **1**: 95. 1841. A Wight herbarium name published as a synonym of *Plagiolytrum calycinum*, which is a plant from India.

Dineba chloridea Presl, Rel. Haenk. **1**: 291. 1830. According to the specimen at Prague this is not a Bouteloua, but probably a Chloris.

Dineba lima Beauv. Ess. Agrost. 98, 160. 1812. Beauvois cites this doubtfully under this genus. The combination is made in his index

Dineba paspaloides Willd.; Beauv. Ess. Agrost. 98, 160. 1812. A name only, probably based upon *Dactylis paspaloides* Willd. Willdenow[d] cites *Dinebra arabica* and *Cynosurus retroflexus* as synonyms of *Dactylis paspaloides*.

Dinebra retroflexa Panzer, Denkschr. Akad. Wiss. (München) **4**: 270. 1814. Based on *Dactylis paspaloides* Willd.

[a] Gen. Pl. 78. 1818.

[b] Ess. Agrost. 98. 1812.

[c] Journ. Linn. Soc. Bot. **19**: 104. 1881.

[d] Enum. Pl. 111. 1809.

Dinebra secunda Roem. & Schult. Syst. Veg. **2**: 711. 1817. Based upon *Cynosurus secundus* Pursh.

Dinebra verticillata Wight; Steud. Syn. Pl. Glum. **1**: 209. 1854. A name cited as synonym of *Leptochloa wightiana*. It is from India and probably not a member of this group.

Enteropogon melicoides Nees; Steud. Syn. Pl. Glum. **1**:216. 1854. A manuscript name published as a synonym of *Eutriana enteropogon*.

Erucaria Cervantes, La Naturaleza (Mexico City) **1**: 347. 1870. There is no way of determining with any certainty what the species described are, and consequently they must be rejected. It is not certain that all of the species belong to this group. Cervantes proposed the following names: *Erucaria glandulosa*, *E. villosa*, *E. hirsuta*, *E. lutescens*, *E. monostachia*, *E. tetrastachia*, *E. longifolia*, and *E. glabra*. Fournier has suggested that *E. glabra* is *B. curtipendula*. The description of *E. glandulosa* and *E. hirsuta* both suggest *B. hirsuta*. *Erucaria lutescens* and *E. monostachia* suggest *B. procumbens* or *B. scorpiodes*. *Erucaria villosa* may be *B. chondrosioides*. *Erucaria tetrastachia* may be *B. gracilis*.

Eutriana antillarum Steud. Syn. Pl. Glum. **1**: 217. 1854. Based upon "*Aristida antillarum* Lam."

Eutriana? chloridea Kunth, Enum. Pl. **1**: 280. 1833. Based upon *Dineba chloridea* Presl.

Eutriana karwinskiana Steud. Nom. Bot. ed. 2. **1**: 620. 1840. A name only, from Trinius's manuscript.

Eutriana ledebourii Trin. Gram. Unifl. 238. 1824. Although citing *Dinebra secunda* Roem. & Schult. (*Cynosurus secundus* Pursh) as a synonym, Trinius gives the habitat as St. Domingo. A specimen named *E. ledebourii* in the Trinius Herbarium, is doubtful. The spikelet is that of a Bouteloua, but the spikes have but a single spikelet. It does not seem probable, then, that this is the same as *B. americana*, but I am not able to decide without more material.

Eutriana melicoides Steud. Syn. Pl. Glum. **1**: 216. 1854. The first synonym cited is an East Indian plant.

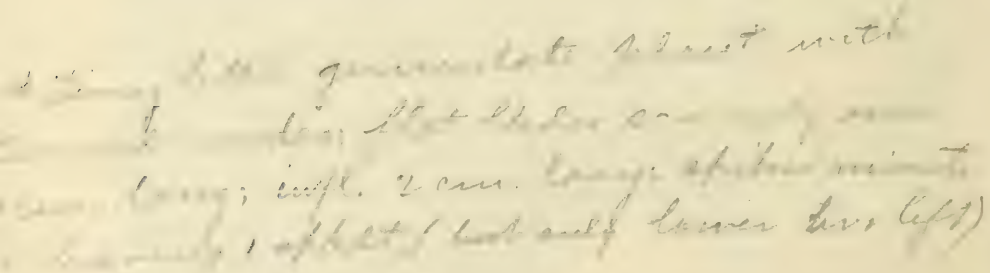
Eutriana villosa Steud. Nom. Bot. ed. 2. **1**: 620. 1840. No description is given, and the synonyms are only manuscript names.

Ischaemum melicoides Koenig; Willd. Sp. Pl. **4**[2]: 941. 1806; Steud. Syn. Pl. Glum. **1**: 216. 1854. Steudel cites this name as a synonym of *Eutriana enteropogon*. The plant is from India and probably does not belong in this group.

Leptochloa arabica Kunth, Rév. Gram. **1**: 91. 1829. Based upon *Dinebra arabica* Jacq.

Pappophorum alopecuroideum Vahl, Symb. Bot. **3**: 10. *pl. 51*. 1794. This has been referred to *Bouteloua megapotamica*, but Vahl's figures show it to be true Pappophorum.

Tripogon bromoides Roth, Nov. Pl. Sp. Ind. Or. 79. 1821. The generic description excludes Bouteloua; Roem. & Schult. Syst. Veg. **2**: 600. 1817. An earlier mention of the name based on *Triathera bromoides* Roth in manuscript.



LIST OF SPECIMENS DEPOSITED IN PUBLIC HERBARIA.[a]

Hitchcock	6074.	Triaenia juncea. Tehuacan, Mexico, August 9, 1910.
Griffiths	8117.	juncea. Dublan, Hidalgo, Mexico, September 7, 1905.
	8122.	juncea. Dublan, Hidalgo, Mexico, September 7, 1905.
	8408.	juncea. Saltillo, Mexico, August 17, 1906.
Hitchcock	6776.	Cathestecum erectum. Balsas, Mexico, September 9, 1910.
Griffiths	6834.	erectum. Imuris to Santa Ana, Sonora, Mexico, August 18–19, 1904.
		multifidum. Iguala, Mexico, September 9, 1909.
Hitchcock	6164.	multifidum. Oaxaca, Mexico, August 12, 1910.
	6072.	stoloniferum. Tehuacan, Mexico, August 9, 1910.
Griffiths	9764.	stoloniferum. Tomellin, Mexico, September 31, 1909.
	5918.	Bouteloua aristidoides. Santa Rita Mountains, Arizona, September 27–October 3, 1903.
	6096.	aristidoides. Deserts of Tucson, Arizona, October, 1903.
	6097.	aristidoides. Deserts southeast of Tucson, Arizona, October, 1903.
	6158.	aristidoides. East of Tucson, Arizona, October 13, 1903.
	7014.	aristidoides. Mesas east of Tucson, Arizona, September 4, 1904.
	7126.	aristidoides. Mount Lemmon, Santa Catalina Mountains, Arizona, September 8, 1904.
	7278.	aristidoides. In depressions, southeast of Tucson, Arizona.
	7286.	aristidoides. Southeast of Tucson, Arizona, September 20, 1904.
	7302.	aristidoides. In depressions, southeast of Tucson, Arizona, September 21–23, 1904.
	7308.	aristidoides. Favorable places, east of Tucson, Arizona, September 21–23, 1904.
	7309.	aristidoides. Favorable places, east of Tucson, Arizona, September 21–23, 1904.
	9862.	aristidoides. Durango, Mexico, September 28, 1909.
Wooton	3063.	barbata. Mesilla Park, New Mexico, October 20, 1904.
Griffiths	5108.	barbata. In irrigated yard, Adamana, Arizona, August 6, 1903.
	5112.	barbata. Adamana, Arizona, August 6, 1903.
	5809.	barbata. Near Navajo, Arizona, September 13, 1903.
	6095.	barbata. Southeast of Tucson, Arizona, October, 1903.
	6208.	barbata. Thornton, New Mexico, October 19, 1903.
	6541.	barbata. Laredo, Texas, June 14, 1904.
	6861.	barbata. Imuris to Altar, Sonora, Mexico, August 19, 1904.
	6890.	barbata. Altar, Sonora, Mexico, August 20, 1904. (Close to *B. arenosa.*)
	6905.	barbata. Altar, Sonora, Mexico, August 20, 1904. (Close to *B. arenosa.*)

[a] See page 348.

Griffiths 7140. Bouteloua barbata. Mount Lemmon, Santa Catalina Mountains, Arizona, September 8–9, 1904.
7156. barbata. Mount Lemmon, Santa Catalina Mountains, Arizona, September 8–9, 1904.
7157. barbata. Mount Lemmon, Santa Catalina Mountains, Arizona, September 8–9, 1904.
7176. barbata. Tucson, Arizona.
7303. barbata. Mesas near Tucson, Arizona, September 23, 1904.
7323. barbata. Prescott, Arizona, September 26, 1904.
7404. barbata. Las Cruces, New Mexico, October 6, 1904.
8116. barbata. Dublan, Mexico, September 7, 1905.
9861. barbata. Dublan, Mexico, September 7, 1905.
5717. breviseta. East of Roswell, New Mexico, September 2, 1903.
5758. breviseta. Bluffs of Pecos River near Roswell, New Mexico, September 4, 1903.
Hitchcock 6150. chondrosioides. Oaxaca, Mexico, August 12, 1910.
Griffiths chondrosioides. San Antonio, Michoacan, Mexico, August 21, 1909.
5971. chondrosioides. Santa Rita Mountains, Arizona, September 27–October 3, 1903.
6124. chondrosioides. Salero Hills, Santa Rita Mountains, Arizona, October 8, 1903.
6732. chondrosioides. Tubac, Arizona, August 15, 1904.
6790. chondrosioides. Cocospora Ranch, Sonora, Mexico, August 17, 1904.
6925. chondrosioides. Laosa, Arizona, August 24, 1904.
7266. chondrosioides. Santa Rita Mountains, Arizona, September 17, 1904.
7270. chondrosioides. Santa Rita Mountains, Arizona, September 17, 1904.
9742. chondrosioides. Oaxaca, Mexico, September, 1909.
9863. chondrosioides. Durango, Mexico, September 28, 1909.
Chase, V. H. 1875. curtipendula. Princeville, Peoria County, Illinois, July 8, 1908.
Griffiths 5614. curtipendula. Texline, Texas, August 26–28, 1903.
7071. curtipendula. Santa Catalina Mountains, Arizona, September 5–10, 1904.
7261. curtipendula. Santa Rita Mountains, Arizona, September 17, 1904.
eludens. Santa Rita Mountains, Arizona.
6746. eludens. Near Nogales, Sonora, Mexico, August 16, 1904.
6789. eludens. Cocospora Ranch, Sonora, Mexico, August 17, 1904.
6947. eludens. Santa Rita Mountains, Arizona, September 29, 1904.
7051. eludens. Santa Catalina Mountains, Arizona, September 5, 1904.
7269. eludens. Santa Catalina Mountains, Arizona, September 18, 1904.
5573. eriopoda. Cimarron Canyon, New Mexico, August 23, 1903.
5968. eriopoda. Santa Rita Mountains, Arizona, September 27–October 3, 1903.
7002. eriopoda. Santa Rita Mountains, Arizona, August 31, 1904.
7186. eriopoda. Santa Rita Mountains, Arizona, September 13–21, 1904.
filiformis. El Llano, Jalisco, Mexico. September 16, 1909.

Hitchcock	5827.	Bouteloua filiformis. Querétaro, Mexico, July 24, 1910.
	5827*a*.	filiformis. Querétaro, Mexico, July 24, 1910.
Griffiths	5916.	filiformis. Santa Rita Mountains, Arizona, October 3, 1903.
	6397.	filiformis. Encinal, Texas, May 20, 1904.
	6791.	filiformis. Cocospora Ranch, Sonora, Mexico, August 17, 1904.
	7178.	filiformis. Santa Catalina Mountains, Arizona, September 10–12, 1904.
	7179.	filiformis. Santa Catalina Mountains, Arizona, September 10–12, 1904.
	7199.	filiformis. Santa Rita Mountains, Arizona, September 13–21, 1904.
	5187.	gracilis. Cimarron Canyon, New Mexico, August 9, 1903.
	5236.	gracilis. St. Johns to White Mountains, Arizona.
	5472.	gracilis. Raton Mountains, New Mexico, August 18, 1903.
	5627.	gracilis. Texline, Texas, August 27, 1903.
	6108.	gracilis. Sonoyta Valley, Arizona, October 7, 1903.
	6710.	gracilis. Colorado Springs, Colorado, August 6, 1904.
	9809.	gracilis. Dublan, Mexico, September, 1909.
		hirsuta. Lamy, New Mexico, August 31, 1910.
	5523.	hirsuta. Cimarron Canyon, New Mexico, August 21, 1903.
	5572.	hirsuta. Cimarron Canyon, New Mexico, August 23, 1903.
	5628.	hirsuta. Texline, Texas, August 27, 1903.
	5743.	hirsuta. Thirty miles east of Roswell, New Mexico, September 4, 1903.
	6079.	hirsuta. Santa Rita Mountains, Arizona, October 3, 1903.
	6125.	hirsuta. Salero Mountains, Arizona, October 8, 1903.
	6709.	hirsuta. Colorado Springs, Colorado, August 6, 1904.
	6792.	hirsuta. Near Cocospora Ranch, Sonora, Mexico, August 16, 1904.
	7263.	hirsuta. Santa Rita Mountains, Arizona, September 17, 1904.
		hirticulmis. El Llego, Jalisco, Mexico, September 19, 1909.
	9849.	hirticulmis. Aguascalientes, Mexico, September 29, 1909.
Wooton	3065.	parryi. Mesas near Mesilla Park, New Mexico, October 25, 1904.
Griffiths	5940.	parryi. Santa Rita Mountains, Arizona, September 27–October 3, 1903.
	7001.	parryi. Santa Rita Mountains, Arizona, August 31, 1904.
	7277.	parryi. Santa Rita Mountains, Arizona, September 17, 1904.
	7421.	parryi. Near Mesilla Park, New Mexico, October 6, 1904.
	7422.	parryi. Near Mesilla Park, New Mexico, October 6, 1904.
	7423.	parryi. Near Mesilla Park, New Mexico, October 6, 1904.
	9614.	parryi. Santa Rita Mountains, Arizona, September 21, 1908.
	5110.	procumbens. Adamana, Arizona, August 6, 1903.
	5222.	procumbens. St. John's to White Mountains, Arizona, August 10, 1903.
	5255.	procumbens. White Mountains, Arizona, August 11–15, 1903.
	5277.	procumbens. White Mountains, Arizona, August 11–15, 1903.
	5501.	procumbens. Raton Mountains, New Mexico, August 18, 1903.
	5502.	procumbens. Raton Mountains, New Mexico, August 18, 1903.
	5585.	procumbens. Cimarron Canyon, New Mexico, August 24, 1903.
	6724.	procumbens. Manitou, Colorado, August 7, 1904.
	6725.	procumbens. Manitou, Colorado, August 7, 1904.
	7362.	procumbens. Flagstaff, Arizona, September 28, 1904.
	8139.	procumbens. Zacatecas, Mexico, September 19, 1905.
	9516.	procumbens. Prescott, Arizona, August 31, 1908.

Hitchcock 6780. Bouteloua radicosa. Balsas, Mexico, September 9, 1910.
Griffiths 7012. radicosa. Cultivated at Tucson, Arizona, September 2, 1904.
7050. radicosa. Santa Catalina Mountains, Arizona, September 5–10, 1904.
7180. radicosa. Santa Catalina Mountains, Arizona, September 10–12, 1904.
7181. radicosa. Santa Catalina Mountains, Arizona, September 10–12, 1904.
7198. radicosa. Santa Rita Mountains, Arizona, September 15, 1904.
8124. radicosa. Dublan, Hidalgo, Mexico, September, 1905.
Hitchcock 7040. repens. Manzanillo, Mexico, August 20, 1910.
Griffiths 1556. rothrockii. Fort Lowell, Arizona, September, 1900.
4402. rothrockii. Santa Rita Mountains, Arizona, May 23, 1903.
6111. rothrockii. Cottonwood, Arizona, October 7, 1903.
6149. rothrockii. Baboquivari Mountains, Arizona, October 10, 1903.
6153. rothrockii. Robles Ranch, Pima County, Arizona, October 11, 1903.
6159. rothrockii. Mesas near Tucson, Arizona, October 13, 1903.
6796. rothrockii. Near Cocospora Ranch, Sonora, Mexico, August 17, 1904.
7185. rothrockii. Santa Rita Mountains, Arizona, September 13–21, 1904.
7279. rothrockii. Andrade, Pima County, Arizona, September 20, 1904.
Hitchcock 6272. scorpioides. Chalchicomula, Mexico, August 19, 1910.
Griffiths 8460. scorpioides. Campero, Mexico, August 30, 1906.
8461. scorpioides. Campero, Mexico, August 30, 1906.
8462. scorpioides. Campero, Mexico, August 30, 1906.
8527. scorpioides. Encinillas, Mexico, September 13, 1906.
8054. stolonifera. Alonzo, San Luis Potosí, Mexico, August 11, 1905.
6294. texana. Spofford, Texas, May 8, 1904.
6370. texana. Encinal, Texas, May 20, 1904.
6545. texana. San Antonio, Texas, May 16, 1905.
trinii. Southern Texas.
4112. trinii. Near Tucson, Arizona, April 20–25, 1903.
6104. trinii. Andrade, Pima County, Arizona, October 6, 1903.
6283. trinii. Spofford, Texas, May 8, 1904.
6337. trinii. Eagle Pass, Texas, May 11, 1904. (Closely grazed.)
6338. trinii. Eagle Pass, Texas, May 11, 1904.
6339. trinii. Eagle Pass, Texas, May 11–13, 1904.
6372. trinii. Encinal, Texas, May 20, 1904.
6366. trinii. Encinal, Texas, May 20, 1904.
6429. trinii. Torrecillas, Texas, May 24, 1904.
6430. trinii. Torrecillas, Texas, May 24, 1904.

INDEX.

[Page number of principal entries in heavy-face type. Synonyms in italics.]

Page.

Actinochloa 364, 365
barbata 383
bromoides 410
ciliata 375
gracilis 376
hirsuta 372
humilis 366, 367
juncifolia 414
ovata 399
procumbens 364
prostrata 365
scorpioides 369
simplex 366
tenuis 364, 365
Agropyron smithii 344
Andropogon 344, 345, 374
Antichloa 364
Aristida *americana* 364, **407,** 408, 411, 414
antillarum 423, 424
dispersa 407, 408
furcata 407
humboldtiana 398
minuta 422
secunda 422
unilateralis 396
Aristidium 364
Atheropogon 363, 423
acuminatus 406
affinis 420
americanus 408
depauperatus 415
antillarum 423
apludioides 364, 419, 423
aristidoides 396
bromoides 408, 411
chondrosioides 399
curtipendulus 419
distichus 416
domingensis 354
gracilis 376
hirtus 372
humilis 367
medius 423
oligostachyus 376
papillosus 372, 373
pentarrhaphis 356
polymorphus 357
procumbens 364
racemosus 419
radicosus 411
repens 410
scorpioides 369
stolonifer 362
triaena 354
villosus 423

Page.

Bouteloua **363**
acuminata **406**
alamosana **395,** 396
americana **407,** 408, 409, 411, 412, 413, 415, 416, 424
arenosa 383, 384, **385,** 386, 393, 425
aristidoides 344, 347, 348, **396,** 397, 423, 425
aschenborniana 373
barbata 344, 347, **382,** 383, 384, 385, 386, 390, 392, 393, 394, 425, 426
bolanderi 373
brachyathera 367, 368
brevifolia 390
breviseta **379,** 380, 381, 426
bromoides 364, 405, 409, 410, 411, 413, 423
burkii 387, 388, 389
chondrosioides 344, 345, 348, 362, **399,** 400, 401, 402, 424, 426
ciliata 396
curtipendula 344, 345, 346, 347, 348, 350, 354, 398, 399, 401, 402, 406, 407, 413, 418, **419,** 420, 423, 424, 426
aristosa 419
disticha **416,** 417
elatior 408
eludens 347, **401,** 402, 426
eriopoda 347, 387, **390,** 426
filiformis 344, 345, 347, 348, 408, 409, 410, 411, 412, **413,** 426, 427
foena 373
fournieriana 357
gracilis Hook 396
gracilis Lag 344, 345, 346, 370, 371, 372, 374, **375,** 376, 377, 400, 417, 423, 424, 427
havardii 399
heterostega 408, **414,** 415
hirsuta 344, 345, 347, 348, 371, **372,** 373, 374, 375, 420, 424, 427
major 373
minor 373
palmeri 373
hirta 372, 373
major 373
minor 373
hirticulmis **371,** 372, 427
humboldiana 413, 414, 415
humilis 367
juncifolia 414, 415
karwinskii **394**
litigiosa 407, 408
lophostachya **405**
major 376
megapotamica **402,** 403, 424

Page.

Bouteloua *melicaeformis* ... 419
melicoides ... 419
micrantha ... 391, 393
microstachya ... 383
multiseta ... 402
nana ... 405
oligostachya ... 375, 376, 383
intermedia ... 376
major ... 376
pallida ... 376
ramosa ... 381
ovata ... 399
palmeri ... 373
parryi ... 347, **381**, 382, 427
pendula ... 419
pilosa ... **417**
polystachya ... 383
major ... 391
vestita ... 381
porphyrantha ... 414, 415
pringlei ... **398**
procumbens ... **364**, 366, 370, 371, 419, 424, 427
prostrata ... 364, 368
pumila ... 383
pusilla ... 365
racemosa ... 348, 364, 419
radicosa ... 344, 345, 347, 348, 364, 408, 409, **411**, 412, 413, 416, 428
rahmeri ... 367, 368
ramosa ... **381**
repens ... 348, 408, **409**, 410, 428
rothrockii ... 347, 385, **391**, 392, 393, 428
scorpioides ... **369**, 370, 424, 428
simplex ... **366**, 367
sonorae ... 383, **389**, 390
stolonifera ... 368, **369**, 394
stricta ... 376, 377, 378
tenuis ... 365
texana ... 354, 396, 402, **404**, 428
triaena ... 354
triathera ... 408
trifida ... 387, 388, 389
trinii ... 357, **387**, 388, 389, 394, 423, 428
uniflora ... 350, 364, 407, **418**
vaneedeni ... **407**
vestita ... 381
Bulbilis ... 346, 367, 377
Cathestecum ... 349, 351, **358**
erectum ... **361**, 362, 425
multifidum ... **360**, 425
prostratum ... **359**, 361
stoloniferum ... **362**, 363, 425
Chloris ... 383, 423
curtipendula ... 348, 364, 419
filiformis ... 365
procumbens ... 364, 365
tenuis ... 365
Chondrosium ... 349, 364
aschenbornianum ... 372, 373
ciliatum ... 375
drummondii ... 373
eriopodum ... 390
exile ... 383
foenum ... 373
gracile ... 375, 376
hirsutum ... 372
hirtum ... 372, 373

Page.

Chondrostum humboldtianum ... 399, 414
humile ... 366
karwinskii ... 394
microstachyum ... 383
oligostachyum ... 376
papillosum ... 373
parryi ... 381
polystachyum ... 383, 387
procumbens ... 364
prostratum ... 365
scorpioides ... 369
simplex ... 367
subscorpioides ... 423
tenue ... 365, 369
trinii ... 387, 388
virletii ... 423
Corethrum bromoides ... 423
Cultivation, adaptability of grama grasses to ... 345, 420
Cynosurus retroflexus ... 364, 423
secundus ... 423, 424
Dactylis paspaloides ... 423
Deyeuxia brasiliensis ... 423
Dineba ... 364
aegyptiaca ... 364, 423
americana ... 364, 407
arabica ... 364, 423
chloridea ... 423, 424
cristata ... 354
curtipendula ... 364, 419
divaricata ... 416
hirsuta ... 396
juncifolia ... 414
lima ... 423
paspaloides ... 423
repens ... 409
secunda ... 422
Dinebra ... 349, 423
arabica ... 423, 424
aristidoides ... 364, 396
brevifolia ... 423
bromoides ... 410, 411
calycina ... 423
chondrosioides ... 399, 414
repens ... 410, 411
retroflexa ... 423
secunda ... 424
verticillata ... 424
Enteropogon melicoides ... 424
Erucaria ... 350, 364, 424
glabra ... 424
glandulosa ... 424
hirsuta ... 424
longifolia ... 424
lutescens ... 424
monostachia ... 424
tetrastachia ... 424
villosa ... 424
Eutriana ... 364
affinis ... 419, 420
antillarum ... 424
aristidoides ... 396
barbata ... 383
bromoides ... 408, 411
chloridea ... 424
cristata ... 354, 399
curtipendula ... 419
enteropogon ... 424

	Page.
Eutriana gracilis	376, 417
heterostega	414
hirsuta	396
hirta	372
humilis	367
juncea	407
juncifolia	407, 414
karwinskiana	424
lagascae	414, 415
ledebourii	422, 424
melicoides	424
multiseta	364, 402
oligostachya	376
pentarrhaphis	356
pilosa	417
polyodon	416
racemosa	354, 420
tenuis	365
triaena	354
villosa	423, 424
Fournier's Mexicanas Plantas, date of	350
Grama, black	391
blue	378
side-oat	420
Gyp grass	380
Hay, grama grasses cut for	345
Herbaria wherein are deposited illustrative sets of grama grasses	348
Heteropogon	345
Heterosteca	363
americana	407, 414
juncifolia	363, 409
rhadina	415
Heterostega	349
festucaeformis	411
Heterostegon curtipendulus	419
Hilaria	347
cenchroides	363
Ischaemum *melicoides*	424
Koeleria	344
Leptochloa	345, 406
arabica	423, 424
Leptochloa dubia	413
wightiana	424
Melica *curtipendula*	419
Muhlenbergia	345
pungens	406
Nestlera	364
festucaeformis	364, 411
Panicum	345
Pappophorum *alopecuroideum*	424
eutrianoides	402
megapotamicum	402
Pasture grasses	344
Pentarrhaphis	350, 351, **355**
fournieriana	357
geminata	357
polymorpha	**357**
scabra	350, 355, **356**
Plagiolytrum calycinum	423
Polyodon	349, 364
distichum	364, 416
texanus	404
Polyschistis	355
paupercula	355, 356
Side-oat grama	420
Specimens deposited in public herbaria, list of	425
Strombodurus	355
gracilis	355
Triaena	350, 351, **354**
juncea	**354**, 355, 420, 425
racemosa	354
Triathera	363
americana	407, 408
aristidoides	396
bromoides	424
gracilis	354, 420
juncea	354
racemosa	354
Triplathera	364
Tripogon bromoides	424
Types of new species, where deposited	348
Woolly-foot	390

9368°—12——7

